



STIC Search Report

EIC 1700

STIC Database Tracking Number: 138475

TO: Basia Ridley
Location: Rem 7A44
Art Unit : 1764
November 30, 2004

Case Serial Number: 09/816694

From: Usha Shrestha
Location: EIC 1700
REMSEN 4B28
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- Provide examples or give us relevant citations, authors, etc., if known.

- FAX or send the **abstract, pertinent claims** (not all of the claims), **drawings, or chemical structures** to your EIC or branch library.

Enter your Search Topic Information below:

Please search for generation of hydrogen or synthesis gas using autothermal reaction performed at or near the "thermoneutral point".

The autothermal reaction is a combination of steam reforming (endothermal) and partial oxidation (exothermal) reactions.

The operation should include step of calculating the "thermoneutral point" either according to formula in claim 1 (as amended on 7/26/04) or according to any other formula. The thermoneutral point is a point at which the overall chemical reaction is neither exothermic nor endothermic. At this point the steam reforming and partial oxidation reactions are perfectly balanced and all of the heat produced by partial oxidation reaction is used up in the steam reforming reaction.

synonyms:

synthesis gas: syngas, syn gas, syn-gas, synthesis-gas, SNG, split gas, hydrogen & carbon monoxide

autothermal: auto thermal, auto-thermal, autothermic, ATR, EATR

partial oxidation: partial combustion, POX, GPOX, CPO

note that partial oxidation is different from preferential oxidation (PROX)

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EIC17000

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Kathleen Fuller, EIC 1700 Team Leader
571/272-2505 REMSEN 4B28

Voluntary Results Feedback Form

- I am an examiner in Workgroup: Example: 1713
- Relevant prior art **found**, search results used as follows:

- ☐ 102 rejection
- ☐ 103 rejection
- ☐ Cited as being of interest.
- ☐ Helped examiner better understand the invention.
- ☐ Helped examiner better understand the state of the art in their technology.

Types of relevant prior art found:

- ☐ Foreign Patent(s)
- ☐ Non-Patent Literature
(journal articles, conference proceedings, new product announcements etc.)

- Relevant prior art **not found**:

- ☐ Results verified the lack of relevant prior art (helped determine patentability).
- ☐ Results were not useful in determining patentability or understanding the invention.

Comments:

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submitto=STIC-EIC1700@uspto.gov

Name=Basia Ridley

Empno=77699

Phone=571-272-1453

Artunit=1764

Office=REM 7A44

Serialnum=09816694

PatClass=48/61+; 422/139+; 423/648.1-658.3; 429/17, 19-21

Earliest=March 23, 2001

Format3=email

Searchtopic=Please search for generation of hydrogen or synthesis gas using autothermal reaction performed at or near the "thermoneutral point".

The autothermal reaction is a combination of steam reforming (endothermic) and partial oxidation (exothermic) reactions.

The operation should include step of calculating the "thermoneutral point" either according to formula in claim 1 (as amended on 7/26/04) or according to any other formula. The thermoneutral point is a point at which the overall chemical reaction is neither exothermic nor endothermic. At this point the steam reforming and partial oxidation reactions are perfectly balanced and all of the heat produced by partial oxidation reaction is used up in the steam reforming reaction.

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partial oxidation: partial combustion, POX, GPOX, CPO

note that partial oxidation is different from preferential oxidation (PROX)

Comments=

20020174603

METHOD FOR GENERATING HYDROGEN FOR FUEL CELLS

ABSTRACT OF THE DISCLOSURE

5 A method of generating a H₂ rich gas from a fuel includes supplying a mixture of molecular oxygen, fuel, and water to a fuel processor, and converting the mixture of molecular oxygen, fuel, and water in the fuel processor to the H₂ rich gas. The fuel has the formula C_nH_mO_p where n has a value ranging from 1 to 20 and is the average number of carbon atoms per mole of the fuel; m has a value ranging from 2 to 42 and is the average number of hydrogen atoms per mole of the fuel; and p has a value ranging from 0 to 12 and is the average number of oxygen atoms per mole of the
10 fuel. The molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is a value ranging from about 0.5x₀ to about 1.5x₀, and the value of x₀ is equal to $0.312n - 0.5p + 0.5(\Delta H_{f, \text{fuel}}/\Delta H_{f, \text{water}})$ where n and p have the values described above, $\Delta H_{f, \text{fuel}}$ is the heat of formation of the fuel, and $\Delta H_{f, \text{water}}$ is the heat of formation of water.

CLAIMS

What is claimed is:

1. A method of generating a H₂ rich gas from a fuel, comprising:
supplying a mixture of molecular oxygen, fuel, and water to a fuel processor; and
5 converting the mixture of molecular oxygen, fuel, and water in the fuel processor to
the H₂ rich gas, wherein the fuel has the formula C_nH_mO_p where n has a value ranging
from 1 to 20 and is the average number of carbon atoms per molecule of the fuel, m
has a value ranging from 2 to 42 and is the average number of hydrogen atoms per
molecule of the fuel, p has a value ranging from 0 to 12 and is the average number of
10 oxygen atoms per molecule of the fuel, and further wherein the molar ratio of
molecular oxygen supplied to the fuel processor per mole of fuel is represented by the
symbol x and has a value ranging from about 0.5x₀ to about 1.5x₀, wherein x₀ is equal
to $0.312n - 0.5p + 0.5(\Delta H_{f, \text{fuel}}/\Delta H_{f, \text{water}})$ where n and p have the values described
above, $\Delta H_{f, \text{fuel}}$ is the heat of formation of the fuel, and $\Delta H_{f, \text{water}}$ is the heat of formation
15 of water.
2. The method of claim 1, wherein converting the mixture of
molecular oxygen, fuel, and water in the fuel processor to produce the H₂ rich gas
further comprises contacting the mixture of molecular oxygen, fuel, and water with a
catalyst in the fuel processor to produce the H₂ rich gas.
- 20 3. The method of claim 1, wherein the molar ratio of molecular
oxygen supplied to the fuel processor per mole of fuel is x and has a value ranging
from about x₀ to about 1.5x₀.
4. The method of claim 1, wherein the molar ratio of molecular
oxygen supplied to the fuel processor per mole of fuel is x and the molar ratio of water

supplied to the fuel processor per mole of fuel is a value ranging from about $0.8(2n - 2x - p)$ to about $2.0(2n - 2x - p)$.

5. The method of claim 4, wherein the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about $0.9(2n - 2x - p)$ to about $1.5(2n - 2x - p)$.

6. The method of claim 5, wherein the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about $0.95(2n - 2x - p)$ to about $1.2(2n - 2x - p)$.

7. The method of claim 6, wherein the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about $1.0(2n - 2x - p)$ to about $1.1(2n - 2x - p)$.

8. The method of claim 1, wherein the molecular oxygen is supplied to the fuel processor in a mixture of gases comprising N_2 and molecular oxygen.

9. The method of claim 1, wherein the mixture of gases comprising N_2 and molecular oxygen is air.

10. The method of claim 1, wherein the fuel is selected from the group consisting of methane, methanol, ethane, ethylene, ethanol, propane, propene, i-propanol, n-propanol, butane, butene, butanol, pentane, pentene, hexane cyclohexane, cyclopentane, benzene, toluene, xylene, natural gas, liquefied petroleum gas, iso-octane, gasoline, kerosene, and diesel.

11. The method of claim 10, wherein the fuel is selected from the group consisting of methane, natural gas, propane, methanol, ethanol, liquefied petroleum gas, gasoline, kerosene, and diesel.

12. The method of claim 1, wherein the fuel processor comprises a reforming portion and the H₂ rich gas exiting the reforming portion is maintained at a temperature of from about 100°C to about 900°C.

13. The method of claim 1 wherein the fuel processor comprises a reforming portion and the H₂ rich gas exiting the reforming portion is maintained at a temperature of from about 400°C to about 700°C.

14. The method of claim 1, wherein the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is x and has a value ranging from about $0.8x_0$ to about $1.4x_0$.

15. The method of claim 14, wherein the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is x and has a value ranging from about $0.9x_0$ to about $1.3x_0$.

16. The method of claim 15, wherein the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is x and has a value ranging from about $0.95x_0$ to about $1.2x_0$.

17. The method of claim 16, wherein the molar ratio of molecular oxygen supplied to the fuel processor per mole of fuel is x and the molar ratio of water supplied to the fuel processor per mole of fuel is a value ranging from about $1.0(2n - 2x - p)$ to about $1.1(2n - 2x - p)$.

18. The method of claim 2, wherein the catalyst comprises a two part catalyst comprising a transition metal and an oxide-ion conducting portion, and the mixture of molecular oxygen, fuel, and water is contacted with the catalyst at a temperature of 400°C or greater.

19. The method of claim 18, wherein the transition metal is selected from the group consisting of platinum, palladium, ruthenium, rhodium, iridium, iron, cobalt, nickel, copper, silver, gold, and mixtures thereof, and the oxide-ion conducting portion of the catalyst is selected from a ceramic oxide from the group crystallizing in the fluorite structure or LaGaO_3 or mixtures thereof.

20. The method of claim 2, wherein the catalyst is selected from the group of autothermally reforming catalysts that operate at a temperature ranging from about 100°C to about 700°C .

21. The method of claim 2, wherein the H_2 rich gas comprises carbon monoxide and carbon dioxide, and the method further comprises contacting the H_2 rich gas with a second catalyst effective at converting carbon monoxide and water into carbon dioxide and H_2 to produce a second gas further enriched in H_2 and with a reduced level of carbon monoxide.

22. The method of claim 21, wherein the second catalyst comprises a transition metal on cerium oxide or on ceria doped with a rare earth or an alkaline earth element, further wherein the transition metal is selected from the group consisting of platinum, palladium, nickel, iridium, rhodium, cobalt, copper, gold, ruthenium, iron, silver, and combinations thereof, the rare earth element is selected from the group consisting of gadolinium, samarium, yttrium, lanthanum, praseodymium, and combinations thereof, and the alkaline earth element is selected from the group consisting of magnesium, calcium, strontium, barium, and combinations thereof.

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COPPER
OR SILVER OR GOLD OR RARE(A)EARTH OR ALKLINE(A)EARTH)
L57 90 SEA FILE=WPIX ABB=ON PLU=ON L56 AND (METHAN? OR ETHAN?
OR
ETHYLENE OR PROP!NE OR ?PROPANOL OR BUTAN? OR BUTENE OR
PENT!NE OR ?HEXANE OR BENZENE OR TOLUENE OR XYLENE OR
NATURAL(A
)GAS OR PETROLEUM? OR ISOOCTANE OR GASOLINE OR KEROSENE OR
DIESEL)
L59 4 SEA FILE=COMPENDEX ABB=ON PLU=ON L57 AND (AUTO(A)THERM?
OR
ATR OR EATR OR THERMO(3A)NEUTRAL? OR ENDOTHERM? OR
EXOTHERM OR
AUTOTHERM?)

=> d his 160

(FILE 'COMPENDEX' ENTERED AT 15:05:45 ON 30 NOV 2004)

L60 FILE 'HCA, WPIX, COMPENDEX' ENTERED AT 15:14:54 ON 30 NOV 2004
54 DUP REM L55 L58 L59 (3 DUPLICATES REMOVED)
SET COST OFF

FILE 'HCA' ENTERED AT 15:16:39 ON 30 NOV 2004

FILE 'WPIX' ENTERED AT 15:17:13 ON 30 NOV 2004

FILE 'COMPENDEX' ENTERED AT 15:18:01 ON 30 NOV 2004

=> d all 1-

YOU HAVE REQUESTED DATA FROM FILE 'HCA, WPIX, COMPENDEX' - CONTINUE?
(Y)/N:y

YOU HAVE REQUESTED DATA FROM 54 ANSWERS - CONTINUE? Y/(N):y

L60 ANSWER 1 OF 54 HCA COPYRIGHT 2004 ACS on STN DUPLICATE 1
AN 140:220494 HCA
ED Entered STN: 25 Mar 2004

TI Dynamic sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells

IN Randhava, Surjit; Ho, W. S. Winston; Kao, Richard L.; Camara, Elias H.

PA H2Fuel, LLC, USA; University of Kentucky Research Foundation

SO U.S. Pat. Appl. Publ., 19 pp.
CODEN: USXXCO

DT Patent

LA English

IC ICM C01B003-26
ICS B01J008-00

NCL 423652000; 422198000; 422190000; 422211000

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)
Section cross-reference(s): 49, 52, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 2004047799	A1	20040311	US 2002-236324	20020906
PRAI	US 2002-236324		20020906	10/	

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
US 2004047799	ICM	C01B003-26
	ICS	B01J008-00
	NCL	423652000; 422198000; 422190000; 422211000

AB A dynamic sulfur tolerant process with inline acid gas-selective removal for converting sulfur-containing carbonaceous fuels into **hydrogen** or **hydrogen** rich gases includes the following steps: vaporizing liquid fuels and **water** in a vaporizer/preheater by transferring heat from reformat gas; feeding fuel, **water** and oxidant (air or **oxygen**) over a sulfur tolerant catalyst in an **autothermal** hydrodesulfurizing reformer (AHR) to yield a **hydrogen** rich reformat gas to combine the heat effects of the partial oxidation, steam reforming reactions, preheat and heat losses; converting **CO** and steam in the reformat gas to addnl. **hydrogen** and **CO2** via a **water** gas shift (WGS) reaction in a WGS reactor; vaporizing and superheating **water** fed to a WGS boiler coil in a steam generator; removing selectively substantial amts. of acid gas (H2S and **CO2**) in WGS product gas in an acid-gas selective membrane separator (ASMS); further reducing **CO** and **CO2** concentration levels in a **methanator**; and interchanging heat between **hydrogen**-rich gas and sweep gas in a heat interchanger. The ASMS product gas at 180-230° containing 0.5-2 mol% **CO** and <100 ppb H2S is an ideal feed for phosphoric acid fuel cells. The ASMS enables the

methanation reaction equilibrium to decrease the **CO** and **CO2** concns. in the **hydrogen**-rich gas to **appropriate** levels suitable for feeding PEM and alkaline fuel cells. The acid gas-selective membrane in the ASMS consists of polyamine and polyimide blends and copolymers which have a high acid gas/**H2** selectivity and a good thermal stability of $\leq 325^{\circ}\text{C}$. The membrane can consist of poly (2 or 4-vinylpyridine) and polyimide derived from polyamic acid which is synthesized from oxydianiline and oxydiphthalic anhydride. The fuel can be **gasoline**, **diesel**, naphtha, **natural gas**, liquefied **petroleum** gas (LPG), heating oil, **kerosene**, jet fuel, alkanes, alkenes, aroms., and hydrocarbon streams and alcs. selected from the group consisting of **methanol**, **ethanol**, **butanol**, **pentanol**, or alc.-containing steams. The AHR catalyst contains a Group IV rare earth metal sulfide, or a Group IV rare earth metal sulfate as hydrodesulfurization portion, a Group VIII transition metal and an alloy of a Group VIII transition metal as a dehydrogenation portion, and a ceramic oxide, a doped oxide, such as **ZrO2**, **CeO2**, **Bi2O3**, **BiVO4**, **LaGdO3**, **Gd** doped ceria, as an oxidation portion.

ST fuel reforming hydrodesulfurization **hydrogen** prodn acid gas removal membrane; **hydrogen** prodn purifn membrane
methanation fuel cell

IT Transition metal alloys
 RL: **CAT (Catalyst use)**; **USES (Uses)**
 (Group VIII; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)

IT Membranes, nonbiological
 (acid-gas selective; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)

IT Fuel cells
 (alkaline fuel cells; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)

IT Group VIII elements
 RL: **CAT (Catalyst use)**; **USES (Uses)**
 (alloys; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)

IT **Petroleum** refining catalysts
 (dehydrogenation; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)

IT **Petroleum** products
 (gases, liquefied; sulfur tolerant process and system with inline acid

- gas-selective removal for generating **hydrogen** for fuel cells)
- IT Polyamines
Polyimides, uses
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(membrane; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT Dehydrogenation catalysts
(**petroleum** refining; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT Rare earth salts
RL: **CAT (Catalyst use)**; USES (Uses)
(sulfides and sulfates; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT **Diesel** fuel
Fuel cells
Heat transfer
Hydrodesulfurization
Hydrodesulfurization catalysts
Jet aircraft fuel
Methanation
Water gas shift reaction
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT Group VIII elements
Transition metals, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT Alcohols, reactions
Alkanes, reactions
Alkenes, reactions
Aromatic hydrocarbons, reactions
Gasoline
Kerosene
Naphtha
Natural gas, reactions
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT Fuel gas manufacturing
(synthesis gas, partial oxidation, steam reforming; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)

- IT 7440-54-2, Gadolinium, uses
RL: CAT (Catalyst use); MOA (Modifier or additive use); USES (Uses)
(ceria doped with; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT 25232-41-1, Poly(4-vinylpyridine) 25736-02-1
RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
(membrane; sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT 1304-76-3, Bismuth oxide (Bi2O3), uses 1306-38-3, Cerium oxide (CeO2), uses 1314-23-4, Zirconium oxide (ZrO2), uses 14059-33-7, Bismuth vanadium oxide (BiVO4) 104520-69-6, Gadolinium lanthanum oxide (GdLaO3)
RL: CAT (Catalyst use); USES (Uses)
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT 1333-74-0P, Hydrogen, uses
RL: CPS (Chemical process); NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PUR (Purification or recovery); SPN (Synthetic preparation); PREP (Preparation); PROC (Process); USES (Uses)
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT 124-38-9, Carbon dioxide, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PYP (Physical process); REM (Removal or disposal); PROC (Process)
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT 64-17-5, Ethanol, reactions 67-56-1, Methanol, reactions 30899-19-5, Pentanol 35296-72-1, Butanol
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)
- IT 7783-06-4, Hydrogen sulfide (H2S), processes
RL: PEP (Physical, engineering or chemical process); PYP (Physical process); REM (Removal or disposal); PROC (Process)
(sulfur tolerant process and system with inline acid gas-selective removal for generating **hydrogen** for fuel cells)

ED Entered STN: 29 Jul 2004
 TI Catalytic process for the production of olefins
 IN Little, Ian Raymond; Reid, Ian Allan Beattie
 PA BP Chemicals Limited, UK
 SO PCT Int. Appl., 17 pp.
 CODEN: PIXXD2
 DT Patent
 LA English
 IC ICM C07C005-48
 ICS C10G011-22; C10G051-02
 CC 35-2 (Chemistry of Synthetic High Polymers)
 Section cross-reference(s): 23, 48, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2004054945	A1	20040701	WO 2003-GB4993	20031118
CN,	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH,				
GE,	CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD,				
LK,	GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,				
NZ,	LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO,				
TM,	OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ,				
AZ,	TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW, AM,				
	BY, KG, KZ, MD				
BE,	RW: BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AT,				
LU,	BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT,				
GN,	MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA,				
	GQ, GW, ML, MR, NE, SN, TD, TG				

PRAI GB 2002-29497 A 20021218

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 2004054945	ICM	C07C005-48
	ICS	C10G011-22; C10G051-02

AB A process for the production of olefins (e.g., **ethylene**) from a hydrocarbon comprises: (a) passing a first feed stream comprising gaseous

reactants to a first reaction zone where the gaseous reactants react **exothermically** to provide a product stream; (b) producing a mixed feed stream comprising **oxygen** by passing the product stream

produced in step (a) and a second feed stream comprising a hydrocarbon feedstock (e.g., **ethane**) to a mixing zone, **oxygen** being passed to the mixing zone via (i) the product stream produced in step (a), (ii) the second feed stream comprising a hydrocarbon feedstock, and/or (iii) a third stream comprising an **oxygen**-containing gas; (c) passing the mixed feed stream directly to an essentially adiabatic second

reaction zone where in the absence of a supported platinum group metal catalyst at least a part of the **oxygen** is consumed and a stream comprising olefins is produced; (e) cooling the stream comprising olefins

exiting the second reaction zone to $<650^{\circ}$ within less than 150 ms of formation and where the temperature of the mixed stream is $\geq 500^{\circ}$, the mixing zone and the second reaction zone are maintained at a pressure of between 1.5-50 bar and the residence time within the mixing zone is less than the autoignition delay for the mixed stream.

ST **ethylene** catalytic manuf

IT Alkenes, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)
(catalytic process for the production of olefins)

IT Alkanes, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)
(catalytic process for the production of olefins from alkanes)

IT Dehydrogenation

Synthesis gas
(in a catalytic process for the production of olefins)

IT Platinum-group metals

RL: **CAT (Catalyst use)**; USES (Uses)
(in a catalytic process for the production of olefins)

IT Dehydrogenation catalysts

(promoted Pd in a catalytic process for the production of olefins from alkanes)

IT Ceramics

Porcelain

(reactor packing materials; in a catalytic process for the production of olefins)

IT **7440-05-3**, Palladium, uses

RL: **CAT (Catalyst use)**; USES (Uses)
(in a catalytic process for the production of olefins)

IT **74-85-1P**, **Ethylene**, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)
(in a catalytic process for the production of olefins)

IT **74-84-0**, **Ethane**, reactions **124-38-9**,

Carbon dioxide, reactions 630-08-0,
Carbon monoxide, reactions 1333-74-0,
Hydrogen, reactions 7732-18-5, **Water**,
reactions 7782-44-7, **Oxygen**, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)
(in a catalytic process for the production of olefins)

IT 1344-28-1, Alumina, uses 7631-86-9, Silica, uses

RL: NUU (Other use, unclassified); USES (Uses)
(reactor packing materials; in a catalytic process for the
production of
olefins)

RE.CNT 6 THERE ARE 6 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

- (1) Charles, G; US 6395944 B1 2002 HCA
- (2) Charles, G; US 6433234 B1 2002 HCA
- (3) Hoechst Ag; GB 921305 A 1963
- (4) Ohshima, M; US 4527003 A 1985 HCA
- (5) Ohshima, M; US 4655904 A 1987 HCA
- (6) Read, A; US 4264435 A 1981 HCA

L60 ANSWER 3 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 140:323938 HCA

ED Entered STN: 06 May 2004

TI **Hydrogen** manufacture by catalytic conversion of **gasoline**

IN Bakker, Geert Marten; Cracknell, Roger Francis; Kramer, Gert Jan;
Morley,

Christopher; Vos, Eric Johannes

PA Shell Internationale Research Maatschappij B.V., Neth.

SO PCT Int. Appl., 19 pp.

CODEN: PIXXD2

DT Patent

LA English

IC ICM C01B003-38

ICS C01B003-32

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)

Section cross-reference(s): 52, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2004035468	A1	20040429	WO 2003-EP50711	20031013
	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH,				
CN,	CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD,				
GE,	GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,				
LK,	LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO,				
NZ,					

TM, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ,
 AZ, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW, AM,
 BG, BY, KG, KZ, MD
 MC, RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AT, BE,
 GQ, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU,
 NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN,
 GW, ML, MR, NE, SN, TD, TG
 US 2004136901 A1 20040715 US 2003-685029 20031014
 PRAI EP 2002-257104 A 20021014

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 2004035468	ICM	C01B003-38
	ICS	C01B003-32
AB	A gasoline composition is catalytically converted into CO and H2 by contacting a mixture of gasoline and an oxygen -containing gas and/or steam with a catalyst for steam reforming, autothermal reforming, or partial oxidation. The gasoline mixture contains $\leq 40\text{vol.}\%$ alkylates, $\leq 3\text{vol.}\%$ olefins, and 1-15 volume% of oxygenates, such as methanol , ethanol , isopropanol , tert. Bu alc., MTBE, or ETBE. The obtained CO/H2 mixture is subjected to a water gas shift reaction to oxidize CO to CO2 . The H2 -rich gas stream is fed to the anode of a fuel cell.	
ST	gasoline hydrogen manuf reforming fuel cell	
IT	Fuel cells	
	Steam reforming catalysts	
	Water gas shift reaction	
	(hydrogen manufacture by catalytic conversion of gasoline)	
IT	Gasoline	
	RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)	
	(hydrogen manufacture by catalytic conversion of gasoline)	
IT	Fuel gas manufacturing	
	(partial oxidation; hydrogen manufacture by catalytic conversion of gasoline)	
IT	Oxidation catalysts	
	(partial; hydrogen manufacture by catalytic conversion of gasoline)	
IT	Fuel gas manufacturing	
	(steam reforming; hydrogen manufacture by catalytic conversion of	

- gasoline)**
- IT 205519-33-1, Resistalloy
RL: **CAT (Catalyst use)**; USES (Uses)
(catalyst support; **hydrogen** manufacture by catalytic conversion of **gasoline)**
- IT 1306-38-3, Ceria, uses 7439-88-5, Iridium, uses 7440-16-6, Rhodium, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(**hydrogen** manufacture by catalytic conversion of **gasoline**)
- IT 1333-74-0P, **Hydrogen**, preparation
RL: CPS (Chemical process); **IMF (Industrial manufacture)**; PEP (Physical, engineering or chemical process); **PREP (Preparation)**; PROC (Process)
(**hydrogen** manufacture by catalytic conversion of **gasoline**)
- IT 630-08-0P, **Carbon monoxide**, preparation
RL: CPS (Chemical process); IMF (Industrial manufacture); PEP (Physical, engineering or chemical process); RCT (Reactant); **PREP (Preparation)**; PROC (Process); RACT (Reactant or reagent)
(**hydrogen** manufacture by catalytic conversion of **gasoline**)
- IT 64-17-5, **Ethanol**, reactions 67-56-1, **Methanol**, reactions 67-63-0, **Isopropanol**, reactions 75-65-0, tert. **Butyl** alcohol, reactions 106-98-9, 1-**Butene**, reactions 109-67-1, 1-**Pentene** 110-82-7, **Cyclohexane**, reactions 111-66-0, 1-Octene 142-82-5, n-Heptane, reactions 540-84-1, Isooctane 592-41-6, 1-Hexene, reactions 637-92-3 1634-04-4, MTBE 25167-70-8, Diisobutylene
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(**hydrogen** manufacture by catalytic conversion of **gasoline**)
- IT 1314-23-4, Zirconia, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(yttria-stabilized, catalyst support; **hydrogen** manufacture by catalytic conversion of **gasoline)**
- IT 1314-36-9, Yttria, uses
RL: **CAT (Catalyst use)**; MOA (Modifier or additive use); USES (Uses)
(zirconia stabilized with, catalyst support; **hydrogen** manufacture by catalytic conversion of **gasoline)**
- RE.CNT 8 THERE ARE 8 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE
(1) Anon; PATENT ABSTRACTS OF JAPAN 2002, V2000(26)
(2) Graham, H; WO 03022735 A 2003 HCA

- (3) Idemitsu, K; EP 1266949 A 2002 HCA
- (4) Idemitsu Kosan Co Ltd; JP 2001262163 A 2001 HCA
- (5) Ito, N; US 4088608 A 1978
- (6) Johannes, P; WO 9919249 A 1999 HCA
- (7) Klouz, V; JOURNAL OF POWER SOURCES 2002, V105(1), P26 HCA
- (8) Mobil Oil Corp; WO 9965097 A 1999 HCA

L60 ANSWER 4 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 140:323488 HCA

ED Entered STN: 06 May 2004

TI Integrated combustion reactors and methods of conducting simultaneous
endothermic and **exothermic** reactions

IN Qiu, Dongming; Schmidt, Matthew B.; Perry, Steven T.; Fitzgerald,
Sean P.;

Hesse, David J.; Gano, Nathan P.; Long, Richard Q.; Rogers, Wm. Allen;
Arora, Ravi; Yuschak, Thomas D.; Forte, Thomas; Monahan, John Arthur;
Jetter, Robert; Simmons, Wayne W.; Yang, Barry L.; Kuhlmann, David J.;
Wang, Yong; Luzenski, Robert J.; Chadwell, G. Bradley; Peng, Ying;
Mathias, James A.; Tonkovich, Anna Lee; Roberts, Gary; Neagle, Paul W.

PA Velocys, Inc., USA

SO PCT Int. Appl., 132 pp.

CODEN: PIXXD2

DT Patent

LA English

IC ICM B01J019-00

CC 48-8 (Unit Operations and Processes)

Section cross-reference(s): 49, **51**, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2004028685	A2	20040408	WO 2003-US22490	20030804
	WO 2004028685	A3	20040812		
	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH,				
CN,	CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE,				
GH,	GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK,				
LR,	LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ,				
OM,	PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,				
TN,	TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, AM, AZ, BY,				
KG,	KZ, MD, RU, TJ				
	RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AT, BE,				
BG,	CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU,				
MC,					

NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN,
 GQ,
 GW, ML, MR, NE, SN, TD, TG
 PRAI US 2002-222196 A 20020815
 CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 2004028685	ICM	B01J019-00

AB Integrated Combustion Reactors (ICRs) and methods of making ICRs are described in which (micro) combustion chambers (or channels) are in direct thermal contact with reaction chambers for an **endothermic** reaction. Particular reactor designs are also described. Processes of conducting reactions in integrated combustion reactors are described and results presented. Some of these processes are characterized by unexpected and superior results, and/or results that can not be achieved with any prior art devices.

ST combustion microreactor integrated **endothermic exothermic** reaction

IT Heaters
 (ceramic; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)

IT Combustion catalysts
 Steam reforming catalysts
 (integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)

IT Hydrocarbons, reactions
Natural gas, reactions
 RL: RCT (Reactant); RACT (Reactant or reagent)
 (integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)

IT Combustion apparatus
 (micro-; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)

IT Reactors
 (microreactors, catalytic; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)

IT Oxidation catalysts
 (partial; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)

IT Heat
 (recovery; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)

IT Reforming apparatus

- (steam, micro-; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT Fuel gas manufacturing
(synthesis gas, partial oxidation, steam reforming; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT 12606-73-4
RL: CAT (Catalyst use); USES (Uses)
(felt; integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT 1309-48-4, Magnesium oxide, uses 1312-81-8, Lanthana 1314-23-4, Zirconia, uses 1344-28-1, Alumina, uses **7440-05-3**, Palladium, uses **7440-16-6**, Rhodium, uses 7440-45-1, Cerium, uses
RL: CAT (Catalyst use); USES (Uses)
(integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT 555-31-7, Aluminum **isopropoxide 7440-05-3D**, Palladium, salts 7440-45-1D, Cerium, salts 10139-58-9, Rhodium nitrate
RL: CAT (Catalyst use); NUU (Other use, unclassified); USES (Uses)
(integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT 7727-37-9, Nitrogen, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT **124-38-9, Carbon dioxide**, formation
(nonpreparative) 11104-93-1, Nitrogen oxide, formation
(nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT **630-08-0, Carbon monoxide**, reactions
RL: FMU (Formation, unclassified); RCT (Reactant); FORM (Formation, nonpreparative); RACT (Reactant or reagent)
(integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT **7732-18-5, Water**, reactions **7782-44-7, Oxygen**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(integrated combustion microreactors and methods for simultaneous **endothermic** and **exothermic** reactions)
- IT **74-82-8P, Methane**, reactions **1333-74-0P, Hydrogen**, reactions
RL: RCT (Reactant); SPN (Synthetic preparation); PREP

(Preparation); RACT (Reactant or reagent)
(integrated combustion microreactors and methods for simultaneous
endothermic and **exothermic** reactions)

L60 ANSWER 5 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN
AN 2004-419720 [39] WPIX
DNN N2004-333145 DNC C2004-157612
TI Operating gas turbine power plant for producing power involves partial
oxidation of **natural gas** in membrane/partial oxidation
reactor by **oxygen** into **hydrogen** and **carbon**
monoxide, which is converted into carbon dioxide in shift reactor.
DC J04 Q51 Q52 X11
IN GRIFFIN, T; HOLMBERG, D; WINKLER, D
PA (ALSM) ALSTOM TECHNOLOGY LTD
CYC 107
PI WO 2004042200 A1 20040521 (200439)* EN 20 F01K023-10
RW: AT BE BG BW CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE IT
KE LS LU MC MW MZ NL OA PT RO SD SE SI SK SL SZ TR TZ UG ZM ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE
DK DM DZ EC EE EG ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG
KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NI NO NZ OM
PG PH PL PT RO RU SC SD SE SG SK SL SY TJ TM TN TR TT TZ UA UG US
UZ VC VN YU ZA ZM ZW
AU 2003298266 A1 20040607 (200469) F01K023-10
ADT WO 2004042200 A1 WO 2003-EP50782 20031103; AU 2003298266 A1 AU
2003-298266
20031103
FDT AU 2003298266 A1 Based on WO 2004042200
PRAI EP 2002-405995 20021119; US 2002-424681P 20021108
IC ICM F01K023-10
ICS F02C003-22; F02C003-30; F02C006-18
AB WO2004042200 A UPAB: 20040621
NOVELTY - Operating a gas power plant involves feeding **natural**
gas (14) with steam (15) and **oxygen** from compressed air
to the second side of a membrane/partial oxidation reactor (4) and
through
a membrane (18) respectively for converting to **H2** and **CO**
, feeding resulting syngas to a **CO** shift reactor (22) for
converting **CO** into **CO2**, then to **CO2** removal
equipment and finally feeding syngas containing **hydrogen** and
water from **CO2** removal equipment to combustion chamber
(5).

DETAILED DESCRIPTION - The surface of membrane is coated with a

catalyst material.

USE - Used for producing power in a steam turbine and electricity in a generator.

ADVANTAGE - This process increases overall efficiency of the power plant. The **water** in the syngas helps to control the combustion temperature and thus lowers nitrogen oxide formation. The design of the membrane/partial oxidation is such that the overall process is **autothermal** and the membrane temperature is 800 deg. C. The carbon dioxide removal rate is around 80%. The membrane/partial oxidation reactor

can be combined to work as an **oxygen** transferring membrane and as well as reactor for the partial oxidation.

DESCRIPTION OF DRAWING(S) - The figure illustrates a gas turbine power plant.

membrane/partial oxidation reactor 4

combustion chamber 5

natural gas 14

steam 15

membrane of the reactor 18

carbon monoxide shift reactor. 22

Dwg.1/2

FS CPI EPI GMPI

FA AB; GI

MC CPI: J04-E09; N06-D

EPI: X11-C01; X11-C10

L60 ANSWER 6 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN

AN 2004-363752 [34] WPIX

CR 2004-339339 [31]; 2004-373386 [35]; 2004-398775 [37]; 2004-418969 [39]

DNC C2004-137251

TI Preparation of partial oxidation or ammoxidation product of propylene, e.g. acrolein, involves subjecting dehydrogenated crude **propane** in the presence of unconverted **propane** to heterogeneously catalyzed gas phase partial reaction.

DC A41 E19

IN ADAMI, C; HECHLER, C; MACHHAMMER, O; MARTAN, H; MULLER-ENGEL, K J; PETZOLDT, J; SCHINDLER, G

PA (BADI) BASF AG

CYC 1

PI US 2004063989 A1 20040401 (200434)* 34 C07C253-24

ADT US 2004063989 A1 US 2003-465659 20030620

PRAI DE 2002-10246119 20021001; DE 2002-10245585 20020927

IC ICM C07C253-24

ICS C07C027-00

AB US2004063989 A UPAB: 20040621

NOVELTY - Preparation of at least one partial oxidation and/or ammoxidation product of propylene involves subjecting crude **propane** (prepared by dehydrogenation or oxydehydrogenation in the presence and/or absence of **oxygen**) in the presence of unconverted **propane** as a constituent of a gas mixture 2, which comprises 1-**butene** content of at most 1 volume% to a heterogeneously catalyzed gas phase partial oxidation and/or partial gas phase ammoxidation.

DETAILED DESCRIPTION - Preparation of at least one partial oxidation

and/or ammoxidation product of propylene involves:

(a) subjecting crude **propane** in the presence of and/or absence of **oxygen** to a homogeneously and/or a heterogeneously catalyzed dehydrogenation and/or oxydehydrogenation to obtain a **propane**- and propylene-containing gas mixture 1;

(b) optionally removing and/or converting to other compounds a portion of the constituents other than **propane** and propylene contained in the gas mixture 1 to obtain a gas mixture 1' comprising **propane** and propylene and also compounds other than **oxygen**, **propane** and propylene; and

(c) subjecting gas mixture 1 and/or gas mixture 1' as a constituent of a gas mixture 2 to a heterogeneously catalyzed gas phase partial oxidation and/or partial gas phase ammoxidation of propylene contained in gas mixture 1 and/or gas mixture 1'. The total content of 1-**butene** of gas mixture 2 is at most 1 volume%.

USE - Preparation of partial oxidation and/or ammoxidation product of

propylene, preferably propylene oxide, acrolein, acrylic acid and acrylonitrile (all claimed).

ADVANTAGE - The method is targeted to a removal of 4C-hydrocarbons, which limit the separation costs, inconvenience required overall and the adverse effect on the economics. The method avoids undesired complete combustion of propylene in the partial oxidation and/or ammoxidation by limiting **propane** content in gas mixture 2.

Dwg.0/0

FS CPI

FA AB; DCN

MC CPI: A01-D04; A01-D05; A01-D08; A01-E07; E07-A03B; E10-A15D; E10-C04G1A;

E10-D01A; E10-J02C3; E33; E33-A04; E33-G; E34; E34-B01; E34-C02; E34-D01; E35; E35-B; E35-C; E35-H; E35-L; E35-N; E35-Q; N01-A; N01-A01; N01-B; N01-C02; N01-C03; N01-D01; N01-D03; N02-A01;

N02-B01;

N02-C01; N02-D01; N02-E; N03-B; N03-C; N03-D; N03-E; N03-F;
N03-G;
N03-H; N07-C01

L60 ANSWER 7 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN
AN 2004-373386 [35] WPIX
CR 2004-339339 [31]; 2004-363752 [34]; 2004-398775 [37]; 2004-418969 [39]
DNC C2004-140481
TI Preparation of partial oxidation or ammoxidation product of propylene,
e.g. acrolein, involves subjecting dehydrogenated crude **propane**
in the presence of unconverted **propane** to heterogeneously
catalyzed gas phase partial reaction.
DC A41 E19
IN ADAMI, C; HECHLER, C; MACHHAMMER, O; MARTAN, H; MUELLER-ENGEL, K J;
PETZOLDT, J; SCHINDLER, G; MULLER-ENGEL, K J
PA (BADI) BASF AG
CYC 2
PI US 2004063988 A1 20040401 (200435)* 33 C07C253-26
DE 10245585 A1 20040408 (200435) C07C253-18
ADT US 2004063988 A1 US 2003-465656 20030620; DE 10245585 A1 DE
2002-10245585
20020927
PRAI DE 2002-10246119 20021001; DE 2002-10245585 20020927
IC ICM C07C253-18; C07C253-26
ICS C07C027-00; C07C047-22; C07C057-04; C07C255-08; C07D301-08;
C07D303-04
AB US2004063988 A UPAB: 20040621
NOVELTY - Preparation of at least one partial oxidation and/or
ammoxidation product of propylene involves subjecting crude propylene
(prepared by dehydrogenation or oxydehydrogenation in the presence
and/or
absence of **oxygen**) in the presence of unconverted
propane as a constituent of a gas mixture 2 which comprises a
total 4C-hydrocarbon content of at most 3 volume%, to a
heterogeneously
catalyzed gas phase partial oxidation and/or ammoxidation.
DETAILED DESCRIPTION - Preparation of at least one partial
oxidation
and/or ammoxidation product of propylene involves:
(a) subjecting crude **propane** in the presence of and/or
absence of **oxygen** to a homogeneously and/or a heterogeneously
catalyzed dehydrogenation and/or oxydehydrogenation to obtain a
propane- and propylene-containing gas mixture 1;
(b) optionally removing and/or converting to other compounds a
portion of the constituents other than **propane** and propylene
contained in the gas mixture 1 to obtain a gas mixture 1' comprising
propane and propylene and also compounds other than **oxygen**
, **propane** and propylene; and

(c) subjecting gas mixture 1 and/or gas mixture 1' as a constituent of a gas mixture 2 to a heterogeneously catalyzed gas phase partial oxidation and/or partial gas phase ammoxidation of propylene contained in gas mixture 1 and/or 1'. The total content of 4C-hydrocarbons of gas mixture 2 is at most 3 volume%.

USE - Preparation of partial oxidation and/or ammoxidation products of propylene e.g. propylene oxide, acrolein, acrylic acid and acrylonitrile (all claimed).

ADVANTAGE - The method is targeted to a removal of 4C-hydrocarbons, which limit the separation costs, inconvenience required overall and the adverse effect on the economics. The method avoids undesired complete combustion of propylene in the partial oxidation and/or ammoxidation by limiting **propane** content in gas mixture 2.

Dwg.0/0

FS CPI

FA AB; DCN

MC CPI: A01-D04; A01-D05; A01-D08; A01-E08; E07-A03B; E10-A01; E10-A10B; E10-A15D; E10-C04G1; E10-D01A; E33; E33-A04; E33-G; E34; E34-B01; E34-C02; E34-D01; E35; N01-A; N01-B; N01-D03; N02-A01; N02-B01; N02-C01; N02-D01; N02-E; N02-E01; N03; N03-B; N03-C; N03-D;

N03-F;

N03-H

L60 ANSWER 8 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN

AN 2004-256364 [24] WPIX

DNC C2004-100063

TI Conducting chemical reaction, e.g. **water**-gas shift reaction in single stage process channel, by flowing reactants through first reaction

zone in the channel, and flowing unreacted reactants and intermediate product through second zone.

DC A17 C04 E19 E35 E36 H04 J04

IN DAYMO, E; MARCO, J L; MAZANEC, T; PAUL JAROSCH, K T; PENG, Y;

SIMMONS, W

W; TONKOVICH, A L; JAROSCH, K; MARCO, J

PA (DAYM-I) DAYMO E; (MARC-I) MARCO J L; (MAZA-I) MAZANEC T; (JARO-I)

PAUL

JAROSCH K T; (PENG-I) PENG Y; (SIMM-I) SIMMONS W W; (TONK-I)

TONKOVICH A

L; (VELO-N) VELOCYS INC

CYC 105

PI US 2004034111 A1 20040219 (200424)* 16 C07C027-26

WO 2004016346 A1 20040226 (200424) EN B01J019-00
RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE IT KE
LS LU MC MW MZ NL OA PT RO SD SE SI SK SL SZ TR TZ UG ZM ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE
DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP
KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NI NO NZ OM PG
PH PL PT RO RU SC SD SE SG SK SL SY TJ TM TN TR TT TZ UA UG UZ VC
VN

YU ZA ZM ZW
AU 2003257944 A1 20040303 (200457) B01J019-00
ADT US 2004034111 A1 US 2002-219956 20020815; WO 2004016346 A1 WO
2003-US23890

20030731; AU 2003257944 A1 AU 2003-257944 20030731

FDT AU 2003257944 A1 Based on WO 2004016346

PRAI US 2002-219956 20020815

IC ICM B01J019-00; C07C027-26

ICS C07C027-06

AB US2004034111 A UPAB: 20040408

NOVELTY - An equilibrium limited chemical reaction is conducted in a single stage process channel (20) by flowing reactants (10) through a first reaction zone in the process channel under a first set of reaction

conditions to produce an intermediate product, and flowing unreacted reactants and the intermediate product through a second reaction zone

in the process channel under a second set of reaction conditions to produce the final product.

DETAILED DESCRIPTION - Conducting an equilibrium limited chemical reaction in a single stage process channel to make a desired product, involve:

(a) flowing reactants through a first reaction zone in the single stage process channel under a first set of reaction conditions to produce

an intermediate product comprising the desired product; and

(b) flowing unreacted reactants and the intermediate product through

a second reaction zone in the process channel under a second set of reaction conditions to produce the final product. The first set of reaction conditions is suitable for producing a first theoretical equilibrium product, and the second set reaction conditions are suitable

for producing a second theoretical equilibrium product. The second theoretical equilibrium product has a higher concentration of the desired

product than the first theoretical equilibrium product.

An INDEPENDENT CLAIM is also included for an apparatus comprising array of single stage process microchannels arranged in rows extending parallel to each other, a catalyst (30) being contained within each single

stage process microchannel; and array of heat exchange channels arranged

in rows extending parallel to each other, with the heat exchange channels

extending transversely of the single stage process microchannels, and the

rows of heat exchange channels and the rows of single stage process microchannels being positioned in separate alternating planes.

USE - The invention is used for conducting equilibrium limited chemical reaction in single stage process channel to make desired product.

The chemical reaction includes an acetylation addition reaction, alkylation, dealkylation, hydrodealkylation, reductive alkylation, animation, ammonia synthesis, aromatization, arylation,

autothermal reforming, carbonylation, decarbonylation, reductive carbonylation, carboxylation, reductive carboxylation, reductive coupling,

condensation, cracking, hydrocracking, cyclization, cyclooligomerization,

dehalogenation, dimerization, epoxidation, esterification, Fischer-Tropsch

reaction, halogenation, hydrohalogenation, homologation, hydration, dehydration, hydrogenation, dehydrogenation, hydrocarboxylation, hydroformylation, hydrogenolysis, hydrometallation, hydrosilation, hydrolysis, hydrotreating, isomerization, methylation, demethylation, metathesis, **methanol** synthesis, nitration, oxidation, partial oxidation, polymerization, reduction, reformation; reverse **water** gas shift, sulfonation, telomerization, transesterification, trimerization, Sabatier reaction, carbon dioxide reforming,

preferential

oxidation, or preferential **methanation**. **H2** from product of **water**-gas shift reaction is used to operate fuel cell (60); to hydrogenate, hydrotreat, hydroalkylate, hydrocrack, or hydrodesulfurize a feedstock; reacted to form **hydrogen** chloride, **hydrogen** bromide, **ethanol**, **methanol** or ammonia; to make metal hydride; to hydrogenate fat or oil; to reduce

metal

ore; or reduce a catalyst. (all claimed)

ADVANTAGE - The two-stage **water**-gas shift reaction is conducted in a single stage process channel where the contact time within

the process channel may be 10-1000 mseconds. These reactors have reaction

zones that are on the order of 1/3-1/900 the size of conventional processing hardware for the same production output.

DESCRIPTION OF DRAWING(S) - The figure is a schematic flow sheet of a process for conducting equilibrium limited chemical reaction.

Reactants 10

Process channel 20

Entrance 21

Catalyst 30

Product 40

Coolant fluid 50

Fuel cell 60

Dwg.2/5

FS CPI

FA AB; GI; DCN

MC CPI: A02-A00A; A04-G01A; A10-B01; C05-A01B; C05-A03; E10-E04L1; E10-E04L2;

E11-A; E11-B01; E11-C; E11-D; E11-E; E11-F; E11-G; E11-H; E31-B02;

E32-A01; E34-B01; E34-C02; E35; H04-E; H04-F02E; J04-E01; J04-E07C;

N01-C02; N01-D01; N01-D02; N02; N03; N07-B; N07-C; N07-D; N07-F; N07-K

L60 ANSWER 9 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 141:143094 HCA

ED Entered STN: 19 Aug 2004

TI Conversion of Liquid Hydrocarbons into **H2** and **CO2** by
Integration of Reforming and the **Water**-Gas Shift Reaction on
Highly Active Multifunctional Catalysts

AU Wang, Linsheng; Murata, Kazuhisa; Inaba, Megumu

CS National Institute of Advanced Industrial Science and Technology,
AIST,

Tsukuba, Ibaraki, 305-8565, Japan

SO Industrial & Engineering Chemistry Research (2004), 43(13), 3228-3232
CODEN: IECRED; ISSN: 0888-5885

PB American Chemical Society

DT Journal

LA English

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **51**, **67**

AB A novel process for converting a mixture hydrocarbon fuel of
methylcyclohexane (MCH) and toluene (model compds. for
gasoline) into **H2** and **CO2** in one step by
integration of steam reforming (SR) and the **water**-gas shift
(WGS) reaction is studied. The multifunctional activity of

Ni-Re/Al2O3

catalyst is directly tested by the coupled process of SR and WGS. A

$\text{CO}_2/(\text{CO} + \text{CO}_2)$ ratio of 92% at a conversion of 15.6% is achieved on Ni-Re/ Al_2O_3 catalyst at 803 °K. The combination of SR and WGS for converting the liquid hydrocarbon fuel into

H_2 and CO_2 is more efficient on two beds of different temps. A high $\text{CO}_2/(\text{CO} + \text{CO}_2)$ ratio of 97% at a hydrocarbon conversion of 17.8% is achieved on the two beds of different temps. The conversion for the coupled process is evidently promoted by the addition of mol. **oxygen** to the reaction system. H_2 and CO_2 are produced as the major products from the liquid hydrocarbon fuel by **auto-thermal** reforming (AR) combined with the WGS reaction on the multifunctional catalyst Ni/CeZSM-5.

The coupled process for converting the liquid hydrocarbon fuel into H_2 and CO_2 is remarkably enhanced by the application of two beds of different temps. A high $\text{CO}_2/(\text{CO} + \text{CO}_2)$ ratio of 95% at a hydrocarbon conversion of 60.1% is achieved by integration of AR and the WGS reaction on two catalyst beds in one reactor.

ST **hydrogen** prodn hydrocarbon fuel steam reforming **water** gas shift; dual bed multifunctional catalyst steam reforming **water** gas shift; nickel rhenium cerium ZSM 5 zeolite multifunctional reforming catalyst

IT Hydrocarbons, preparation

RL: ANT (Analyte); BYP (Byproduct); CPS (Chemical process); PEP (Physical, engineering or chemical process); ANST (Analytical study); PREP (Preparation); PROC (Process)

(C1-4; conversion of liquid hydrocarbons into H_2 and CO_2 by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)

IT Steam reforming

Steam reforming catalysts

Water gas shift reaction

Water gas shift reaction catalysts

(conversion of liquid hydrocarbons into H_2 and CO_2 by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)

IT Reactors

(fixed-bed, catalytic, two sep. beds; conversion of liquid hydrocarbons into H_2 and CO_2 by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)

IT Zeolite ZSM-5

RL: **CAT** (Catalyst use); USES (Uses)

(support; conversion of liquid hydrocarbons into H_2 and

- CO2 by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT **74-82-8P, Methane**, preparation
RL: ANT (Analyte); BYP (Byproduct); ANST (Analytical study); PREP (Preparation)
(conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT **630-08-0P, Carbon monoxide**, preparation
RL: ANT (Analyte); BYP (Byproduct); RCT (Reactant); ANST (Analytical study); PREP (Preparation); RACT (Reactant or reagent)
(conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT **71-43-2, Benzene**, analysis **124-38-9, Carbon dioxide**, analysis
RL: ANT (Analyte); FMU (Formation, unclassified); ANST (Analytical study);
FORM (Formation, nonpreparative)
(conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT **1333-74-0P, Hydrogen**, preparation
RL: ANT (Analyte); IMF (Industrial manufacture); ANST (Analytical study); PREP (Preparation)
(conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT 7440-15-5, Rhenium, uses 726205-09-0, SHT 4 726205-33-0, MDC 7
RL: CAT (Catalyst use); USES (Uses)
(conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT **7782-44-7, Oxygen**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT 7440-44-0, Carbon, formation (nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(deposits on catalyst; conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)
- IT **7440-02-0P, Nickel**, uses 7440-46-2P, Cesium, uses
RL: CAT (Catalyst use); SPN (Synthetic preparation); PREP (Preparation); USES (Uses)
(from nitrate precursor; conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and

water-gas shift reaction on highly active multifunctional catalysts)

IT 108-87-2, **Methylcyclohexane 108-88-3**, Toluene, analysis
RL: ANT (Analyte); CPS (Chemical process); PEP (Physical, engineering or chemical process); ANST (Analytical study); PROC (Process) (model compound for **gasoline**; conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)

IT 13598-65-7, Ammonium perrhenate (NH₄ReO₄)
RL: **CAT (Catalyst use)**; PEP (Physical, engineering or chemical process); PYP (Physical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent); USES (Uses) (precursor; conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)

IT 1344-28-1, Alumina, uses
RL: **CAT (Catalyst use)**; USES (Uses) (support; conversion of liquid hydrocarbons into **H2** and **CO2** by integration of reforming and **water**-gas shift reaction on highly active multifunctional catalysts)

RE.CNT 15 THERE ARE 15 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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- (2) Bharadwaj, S; Fuel Process Technology 1995, V42, P105
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- (14) Wang, L; Appl Catal A: Gen 2004, V257, P43 HCA
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L60 ANSWER 10 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 140:238397 HCA
ED Entered STN: 01 Apr 2004
TI Dynamic effects in **autothermal** systems Application to a coated-wall internally reformed solid oxide fuel cell
AU Aguiar, P.; Chadwick, D.; Kershenbaum, L.
CS Department of Chemical Engineering and Chemical Technology, Imperial

College London, London, SW7 2A2, UK

SO Chemical Engineering Research and Design (2004), 82(A2), 259-266
CODEN: CERDEE; ISSN: 0263-8762

PB Institution of Chemical Engineers

DT Journal

LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49, 51, 67

AB Creation of an **autothermal** system by coupling
endothermic and **exothermic** reactions demands matching
the thermal requirements of two reactions. **Autothermal**
operation is applied here to a solid oxide fuel cell with internal
methane steam reforming (IR-SOFC), for which the excess heat
generated in the cell provides the heat required by the
endothermic reforming reactions. However, such coupling is not
easy to achieve because of the mismatch between the thermal load
associated
with the reforming rate at typical SOFC temps. and the local amount
of heat
available from the fuel cell reactions. This paper compares the
performance of a SOFC with two different internal reformers and
investigates the dynamic response of a coated-wall indirect IR-SOFC to
changes in c.d. It is shown that a coated-wall indirect IR-SOFC
design
could be effective in reducing the IR reaction rate, preventing steep
temperature gradients, and increasing efficiency. Dynamic
simulations show
that, after a pos. c.d. step-change, the intermediate period between
the
disturbance imposed and the new steady-state is characterized by cell
potential undershoot and **hydrogen** conversion and temperature increase.
The SOFC unit studied has a total fuel residence time of 0.22 s, for
which
the response is essentially complete in 320 s.

ST **autothermal** dynamics coated wall reformer solid oxide fuel cell

IT Reforming apparatus
(catalyst coated wall; dynamic effects in **autothermal** system
of coated-wall internally reformed solid oxide fuel cell)

IT Chemical engineering design
Simulation and Modeling, physicochemical
Steam reforming catalysts
(dynamic effects in **autothermal** system of coated-wall
internally reformed solid oxide fuel cell)

IT Heat
(recovery; dynamic effects in **autothermal** system of
coated-wall internally reformed solid oxide fuel cell).

IT Fuel cells
(solid oxide; dynamic effects in **autothermal** system of

- coated-wall internally reformed solid oxide fuel cell)
- IT Synthesis gas manufacturing
(steam reforming synthesis gas manufacturing; dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)
- IT 7440-02-0, Nickel, uses 12068-51-8, Magnesium aluminate (MgAl₂O₄)
RL: CAT (Catalyst use); USES (Uses)
(dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)
- IT 7727-37-9, Nitrogen, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)
- IT 124-38-9, Carbon dioxide, formation (nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)
- IT 630-08-0, Carbon monoxide, reactions
RL: FMU (Formation, unclassified); RCT (Reactant); FORM (Formation, nonpreparative); RACT (Reactant or reagent)
(dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)
- IT 7782-44-7, Oxygen, uses
RL: NUU (Other use, unclassified); RCT (Reactant); RACT (Reactant or reagent); USES (Uses)
(dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)
- IT 1333-74-0P, Hydrogen, uses
RL: NUU (Other use, unclassified); RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent); USES (Uses)
(dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)
- IT 74-82-8, Methane, reactions 7732-18-5, Water, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(dynamic effects in **autothermal** system of coated-wall internally reformed solid oxide fuel cell)

RE.CNT 20 THERE ARE 20 CITED REFERENCES AVAILABLE FOR THIS RECORD
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L60 ANSWER 11 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 140:238177 HCA

ED Entered STN: 01 Apr 2004

TI Influence of flow arrangement in catalytic plate reactors for
methane steam reforming

AU Zanfir, M.; Gavriilidis, A.

CS Department of Chemical Engineering, University College London, London,
WC1E 7JE, UK

SO Chemical Engineering Research and Design (2004), 82(A2), 252-258
CODEN: CERDEE; ISSN: 0263-8762

PB Institution of Chemical Engineers

DT Journal

LA English

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)
Section cross-reference(s): 49, 67

AB A theor. study of the influence of flow arrangement on the thermal
behavior of a catalytic plate reactor (CPR) for steam reforming of
methane using **methane** catalytic combustion as heat
source based on a two-dimensional model is presented. CPR

performance and

thermal behavior is strongly affected by overall and local balance
between

heat generated on the **exothermic** side and heat consumed on the
endothermic one, which in turn is influenced by flow arrangement.
Simulations for **co**-current and counter-current flow were carried
out for similar inlet conditions and catalyst loadings. It was found
that

the reactor is better balanced thermally for **co**-current
operation. For counter-current arrangement, higher conversions and
better

utilization of the overall heat generated in the **exothermic**
process are achieved at the expense of pronounced temperature
extremes. Thus,

reforming conversion for counter-current operation is 62.8% compared with 52% for **co**-current operation, while maximum transverse temperature difference for **co**-current operation is only 16.5 K compared with 310 K for counter-current operation. This increases the chances of the reactor running away and of homogeneous combustion being initiated. Utilization of a non-uniform catalyst distribution can overcome the heat imbalance by inducing favorable reactant depletion along the reactor during counter-current flow.

ST flow arrangement effect catalytic plate reactor **methane** steam reforming

IT Reactors
(catalytic, plate; influence of flow arrangement in catalytic plate reactors for **methane** steam reforming)

IT Chemical engineering design
Combustion
Combustion catalysts
Simulation and Modeling, physicochemical
Steam reforming catalysts
(influence of flow arrangement in catalytic plate reactors for **methane** steam reforming)

IT Noble metals
RL: **CAT (Catalyst use)**; USES (Uses)
(influence of flow arrangement in catalytic plate reactors for **methane** steam reforming)

IT Heat
(recovery; influence of flow arrangement in catalytic plate reactors for **methane** steam reforming)

IT Synthesis gas manufacturing
(steam reforming synthesis gas manufacturing; influence of flow arrangement in catalytic plate reactors for **methane** steam reforming)

IT 7440-02-0, Nickel, uses 12068-51-8, Magnesium aluminate (MgAl₂O₄)
RL: **CAT (Catalyst use)**; USES (Uses)
(influence of flow arrangement in catalytic plate reactors for **methane** steam reforming)

IT 124-38-9, **Carbon dioxide**, formation
(nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(influence of flow arrangement in catalytic plate reactors for **methane** steam reforming)

IT 630-08-0, **Carbon monoxide**, reactions
RL: FMU (Formation, unclassified); RCT (Reactant); FORM (Formation, nonpreparative); RACT (Reactant or reagent)

(influence of flow arrangement in catalytic plate reactors for
methane steam reforming)

IT 74-82-8, **Methane**, reactions 7732-18-5,

Water, reactions 7782-44-7, **Oxygen**, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(influence of flow arrangement in catalytic plate reactors for
methane steam reforming)

IT 1333-74-0P, **Hydrogen**, preparation

RL: SPN (**Synthetic preparation**); PREP (**Preparation**)

(influence of flow arrangement in catalytic plate reactors for
methane steam reforming)

RE.CNT 15 THERE ARE 15 CITED REFERENCES AVAILABLE FOR THIS RECORD
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L60 ANSWER 12 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 141:228038 HCA

ED Entered STN: 23 Sep 2004

TI **Hydrogen** production via **autothermal** reforming of
diesel fuel

AU Pasel, J.; Meissner, J.; Pors, Z.; Palm, C.; Cremer, P.; Peters, R.;
Stolten, D.

CS Institute for Materials and Processes in Energy Systems (IWV 3),
Forschungszentrum Juelich GmbH, Juelich, D-52425, Germany

SO Fuel Cells (Weinheim, Germany) (2004), 4(3), 225-230

CODEN: FUCEFK; ISSN: 1615-6846

PB Wiley-VCH Verlag GmbH & Co. KGaA

DT Journal

LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 49, 51, 67

AB **Hydrogen**, for the operation of a polymer electrolyte fuel cell, can be produced by means of **autothermal** reforming of liquid hydrocarbons. Expts., especially with **ATR** 4, which produces a molar **hydrogen** stream equivalent to an elec. power in the fuel cell of 3 kWel, showed that the process should be preferably run in the temperature range between 700 °C and 850 °C. This ensures complete hydrocarbon conversion and avoids the formation of considerable amts. of **methane** and organic compds. in the product **water**. Expts. with com. **diesel** showed promising results **but** insufficient long-term stability. Expts. concerning the ignition of the catalytic reaction inside the reformer proved that within 60 s after the addition of **water** and hydrocarbons the reformer reached 95% of its maximum molar **hydrogen** flow. Measurements, with respect to reformer start-up, showed that it takes approx. 7 min. to heat up the monolith to a temperature of 340 °C using an external heating device. Modeling is performed, aimed at the modification of the mixing chamber of **ATR** Type 5, which will help to amend the homogeneous blending of **diesel** fuel with air and **water** in the mixing chamber.

ST **hydrogen** prodn **autothermal** reforming **diesel** fuel

IT Alkanes, reactions
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(C13-19; **hydrogen** production via **autothermal** reforming of **diesel** fuel)

IT Fuel cells
(PEM; **hydrogen** production via **autothermal** reforming of **diesel** fuel)

IT Reactors
(catalytic; **hydrogen** production via **autothermal** reforming of **diesel** fuel)

IT Noble metals
RL: CAT (Catalyst use); USES (Uses)
(**hydrogen** production via **autothermal** reforming of **diesel** fuel)

IT **Diesel** fuel
(low-sulfur; **hydrogen** production via **autothermal** reforming of **diesel** fuel)

IT Synthesis gas manufacturing
(steam reforming synthesis gas manufacturing; **hydrogen** production via **autothermal** reforming of **diesel** fuel)

IT 1344-28-1, Alumina, uses

RL: CAT (Catalyst use); USES (Uses)
(hydrogen production via **autothermal** reforming of
diesel fuel)

IT 74-82-8, Methane, processes 124-38-9,
Carbon dioxide, processes 630-08-0,
Carbon monoxide, processes

RL: CPS (Chemical process); FMU (Formation, unclassified); PEP
(Physical,
engineering or chemical process); FORM (Formation, nonpreparative);
PROC

(Process)
(hydrogen production via **autothermal** reforming of
diesel fuel)

IT 7732-18-5, Water, reactions 7782-44-7,
Oxygen, reactions

RL: CPS (Chemical process); PEP (Physical, engineering or chemical
process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(hydrogen production via **autothermal** reforming of
diesel fuel)

IT 1333-74-0P, Hydrogen, preparation

RL: CPS (Chemical process); PEP (Physical, engineering or chemical
process); SPN (Synthetic preparation); PREP
(Preparation); PROC (Process)

(hydrogen production via **autothermal** reforming of
diesel fuel)

RE.CNT 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR THIS RECORD
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L60 ANSWER 13 OF 54 HCA COPYRIGHT 2004 ACS on STN DUPLICATE 2

AN 140:425687 HCA

ED Entered STN: 17 Jun 2004

TI Partial oxidation of light paraffins to synthesis gas in short
contact-time reactors

AU Beretta, Allessandra; Forzatti, Pio

CS Dipartimento di Chimica, Materiali e Ingegneria Chimica "G. Natta",
Politecnico di Milano, Milan, 20133, Italy

SO Chemical Engineering Journal (Amsterdam, Netherlands) (2004), 99(3),
219-226

CODEN: CMEJAJ; ISSN: 1385-8947

PB Elsevier Science B.V.

DT Journal

LA English
CC 49-1 (Industrial Inorganic Chemicals)
Section cross-reference(s): 51, 52
AB The reaction pathways of **ethane** and **propane** partial oxidation to synthesis gas were investigated over a Pt/ γ -Al₂O₃ and a Rh/ α -Al₂O₃ catalyst. An annular reactor was used for this purpose at high space velocities and at temps. below 700 °C in order to avoid homogeneous reactions. Under fuel-rich conditions, the Pt-based catalyst produced **CO** and **H₂** at high temps. (>550 °C), while **CO₂** and **H₂O** were the only reaction products at lower temps. The formation of **CO** and **H₂** was consistent with direct oxidation reactions, since contact time had no effect on the product distribution, and secondary reactions (steam and dry reforming) showed negligible activity. The Rh/Al₂O₃ catalyst was also active and selective in the partial oxidation of light hydrocarbons, **but** in this case the production of **hydrogen** and **CO** was strongly dependent on contact time, and steam reforming was important even at short contact times. It was concluded that, over rhodium, both direct and indirect routes were probably involved in the formation of **CO** and **H₂**. The main difference between the two noble metals thus seemed to be that Pt mainly produced **CO** and **H₂** by means of **O₂** (direct routes), while over Rh the light paraffins were converted to **CO** and **H₂** by means of **O₂** and **H₂O** (direct+indirect routes). This could explain the remarkably different behavior of the two systems when tested in high temperature **autothermal** reactors (T>700 °C). Under adiabatic conditions, the partial oxidation of light paraffins led to large amts. of gas-phase olefinic products over Pt, whereas high selectivities to synthesis gas were found over Rh. The mechanistic results suggest that this different behavior could be due to the varying capability of Pt and Rh surface reactions to compete with homogeneous reactions.
ST **hydrogen** synthesis gas prodn alkane partial oxidn mechanism
IT Reaction mechanism
Synthesis gas manufacturing
(partial oxidation of light paraffins to synthesis gas in short contact-time reactors)
IT Alkenes, formation (nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(partial oxidation of light paraffins to synthesis gas in short

contact-time reactors)
IT Oxidation catalysts
(partial; partial oxidation of light paraffins to synthesis gas in short contact-time reactors)
IT 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses
RL: **CAT (Catalyst use)**; **USES (Uses)**
(on γ -Al₂O₃; partial oxidation of light paraffins to synthesis gas in short contact-time reactors)
IT 74-84-0, **Ethane**, reactions 74-98-6,
Propane, reactions
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent)
(partial oxidation of light paraffins to synthesis gas in short contact-time reactors)
IT 1333-74-0P, **Hydrogen**, preparation
RL: **SPN (Synthetic preparation)**; **PREP (Preparation)**
(partial oxidation of light paraffins to synthesis gas in short contact-time reactors)

RE.CNT 26 THERE ARE 26 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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L60 ANSWER 14 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 140:255952 HCA
ED Entered STN: 08 Apr 2004
TI Efficient bimetallic catalysts for the **hydrogen** production from **diesel** fuel
AU Cheekatamarla, Praveen K.; Lane, Alan M.
CS Department of Chemical Engineering, The University of Alabama, Tuscaloosa, AL, 35487, USA
SO Preprints of Symposia - American Chemical Society, Division of Fuel Chemistry (2004), 49(1), 139-141
CODEN: PSADFZ; ISSN: 1521-4648
PB American Chemical Society, Division of Fuel Chemistry
DT Journal; (computer optical disk)
LA English
CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)
Section cross-reference(s): 49, 67
AB The objective of this investigation was to synthesize and test stable and efficient **autothermal** reforming (**ATR**) catalysts for **hydrogen** production from synthetic **diesel** fuel in auxiliary power units. Exptl. results suggest that the presence of a second metal improves the performance of the **ATR** activity of Pt based catalysts supported on ceria and alumina. Higher intrinsic activity of these samples is possible due to the interaction between these metals as suggested by TPR and XPS results.
ST bimetallic catalyst **hydrogen** prodn **diesel** fuel reforming
IT Steam reforming catalysts
(efficient bimetallic catalysts for **hydrogen** production from **diesel** fuel)
IT Noble metals
Transition metals, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(efficient bimetallic catalysts for **hydrogen** production from **diesel** fuel)
IT Fuel gas manufacturing
(synthesis gas, partial oxidation, steam reforming; efficient bimetallic catalysts for **hydrogen** production from **diesel** fuel)
IT **Diesel** fuel
(synthetic; efficient bimetallic catalysts for **hydrogen**

- production from **diesel** fuel)
- IT 1306-38-3, Ceria, uses 1344-28-1, Alumina, uses
7440-02-0, Nickel, uses 7440-05-3, Palladium, uses
7440-06-4, Platinum, uses
RL: CAT (Catalyst use); USES (Uses)
(efficient bimetallic catalysts for **hydrogen** production from
diesel fuel)
- IT 7727-37-9, Nitrogen, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical
process); PROC (Process)
(efficient bimetallic catalysts for **hydrogen** production from
diesel fuel)
- IT 74-82-8, Methane, formation (nonpreparative)
124-38-9, Carbon dioxide, formation
(nonpreparative) 630-08-0, Carbon monoxide,
formation (nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(efficient bimetallic catalysts for **hydrogen** production from
diesel fuel)
- IT 7732-18-5, Water, reactions 7782-44-7,
Oxygen, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(efficient bimetallic catalysts for **hydrogen** production from
diesel fuel)
- IT 1333-74-0P, Hydrogen, preparation
RL: SPN (Synthetic preparation); PREP (Preparation)
(efficient bimetallic catalysts for **hydrogen** production from
diesel fuel)
- IT 7704-34-9, Sulfur, occurrence
RL: OCU (Occurrence, unclassified); OCCU (Occurrence)
(resistance; efficient bimetallic catalysts for **hydrogen**
production from **diesel** fuel)

RE.CNT 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD
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autothermal reforming of gasoline and water-gas shift reaction 2000

L60 ANSWER 15 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 140:359964 HCA

ED Entered STN: 20 May 2004

TI **Autothermal** reforming of **methane** over Ni/ γ -Al₂O₃
catalysts: the enhancement effect of small quantities of noble metals

AU Dias, Joelmir A. C.; Assaf, Jose M.

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Sao Carlos-SP, 13565-905, Brazil

SO Journal of Power Sources (2004), 130(1-2), 106-110
CODEN: JPSODZ; ISSN: 0378-7753

PB Elsevier Science B.V.

DT Journal

LA English

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)
Section cross-reference(s): 49, 67

AB The effect of introducing small amts. of Pt, Pd and Ir (<0.3% by
weight) into
Ni/ γ Al₂O₃ catalysts (15% Ni weight/weight) for the **autothermal**
reforming of **methane** (**ATR**) was investigated. While
the unpromoted catalyst took the partial oxidation of **methane** to
equilibrium, the promoted ones increased the **methane** conversion in
ATR. No electronic modifications of nickel sites were observed with
the addition of noble metals, **but** they did cause an increase in
metal surface area. The effect of noble metals on this reaction,
under
these conditions, was assigned to this expansion of the metal surface.

ST noble metal effect nickel alumina catalyst **autothermal** reforming
methane

IT Reforming catalysts
(**autothermal**; enhancement effect of noble metals in
autothermal reforming of **methane** over
Ni/ γ -Al₂O₃ catalysts)

IT Platinum-group metals
RL: **CAT (Catalyst use)**; MOA (Modifier or additive use); USES
(Uses)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)

IT Oxidation catalysts
(partial; enhancement effect of noble metals in **autothermal**
reforming of **methane** over Ni/ γ -Al₂O₃ catalysts)

IT Fuel gas manufacturing
(synthesis gas, partial oxidation, steam reforming; enhancement
effect of
noble metals in **autothermal** reforming of **methane**
over Ni/ γ -Al₂O₃ catalysts)

IT **7440-02-0**, Nickel, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)

- IT 7439-88-5, Iridium, uses 7440-05-3, Palladium, uses
7440-06-4, Platinum, uses
RL: CAT (Catalyst use); MOA (Modifier or additive use); USES
(Uses)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)
- IT 7647-10-1, Palladium dichloride 10025-97-5, Iridium chloride (IrCl₄)
13478-00-7, Nickel nitrate hexahydrate 16941-12-1, Platinic(2-),
hexachloro-, dihydrogen, (OC-6-11)-
RL: CAT (Catalyst use); NUU (Other use, unclassified); USES
(Uses)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)
- IT 7727-37-9, Nitrogen, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical
process); PROC (Process)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)
- IT 124-38-9, Carbon dioxide, formation
(nonpreparative) 630-08-0, Carbon monoxide,
formation (nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)
- IT 74-82-8, Methane, reactions 7732-18-5,
Water, reactions 7782-44-7, Oxygen, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)
- IT 1333-74-0P, Hydrogen, preparation
RL: SPN (Synthetic preparation); PREP (Preparation)
(enhancement effect of noble metals in **autothermal** reforming
of **methane** over Ni/ γ -Al₂O₃ catalysts)
- IT 1344-28-1, Alumina, uses
RL: CAT (Catalyst use); USES (Uses)
(γ -; enhancement effect of noble metals in **autothermal**
reforming of **methane** over Ni/ γ -Al₂O₃ catalysts)

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L60 ANSWER 16 OF 54 HCA `COPYRIGHT 2004 ACS on STN

AN 140:201832 HCA

ED Entered STN: 18 Mar 2004

TI Dual catalyst bed concept for catalytic partial oxidation of
methane to synthesis gas

AU Zhu, J.; Rahuman, M. S. M. Mujeebur; van Ommen, J. G.; Lefferts, L.

CS Process Technology Institute Twente, Faculty of Chemical Technology,
Catalytic Processes and Materials, University of Twente, Enschede,

7500

AE, Neth.

SO Applied Catalysis, A: General (2004), 259(1), 95-100

CODEN: ACAGE4; ISSN: 0926-860X

PB Elsevier Science B.V.

DT Journal

LA English

CC 49-8 (Industrial Inorganic Chemicals)

AB A system with two catalyst beds instead of one single metal catalyst
bed

is **proposed** for catalytic partial oxidation of **methane**
(CPOM) to synthesis gas. In this dual catalyst bed system, an
irreducible

stable oxide, such as yttrium-stabilized zirconia (YSZ), is used in
the

first catalyst bed to obtain selective oxidation to syngas with
significant

highly **exothermic** deep oxidation occurring as well. This feature
results in milder temperature profiles in the reactor because less
heat is

liberated compared to initial deep oxidation as, e.g. on metal
catalysts.

More importantly, all **oxygen** is completely consumed in the oxide

catalyst bed. The second bed comprises a metal catalyst, e.g. **Co**-based, for reforming **methane** with **H2O** and **CO2** exclusively. In this way the catalysts are exposed to less extreme temps.

and, exposure of metallic catalysts to **oxygen** at high temps. is prevented. Therefore catalyst deactivation via evaporation of precious metal

oxides is circumvented. Finally, synthesis gas with an equilibrium composition

(almost 100% **CO** and **H2** yields) is produced.

ST **methane** partial oxidn dual catalyst synthesis gas

IT Synthesis gas manufacturing

(dual catalyst bed for catalytic partial oxidation of **methane** to synthesis gas)

IT Oxidation

Oxidation catalysts

(partial; dual catalyst bed for catalytic partial oxidation of **methane** to synthesis gas)

IT **7440-48-4**, Cobalt, uses

RL: **CAT (Catalyst use)**; USES (Uses)

(dual catalyst bed for catalytic partial oxidation of **methane** to synthesis gas)

IT **74-82-8**, **Methane**, processes

RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)

(dual catalyst bed for catalytic partial oxidation of **methane** to synthesis gas)

IT 1314-23-4, Zirconia, uses **7440-65-5**, Yttrium, uses

RL: **CAT (Catalyst use)**; USES (Uses)

(yttrium-stabilized zirconia; dual catalyst bed for catalytic partial

oxidation of **methane** to synthesis gas)

RE.CNT 26 THERE ARE 26 CITED REFERENCES AVAILABLE FOR THIS RECORD

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L60 ANSWER 17 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 140:220566 HCA

ED Entered STN: 25 Mar 2004

TI **Autothermal** reforming of CH₄ over supported Ni catalysts prepared from Mg-Al hydrotalcite-like anionic clay

AU Takehira, Katsuomi; Shishido, Tetsuya; Wang, Peng; Kosaka, Tokuhisa; Takaki, Ken

CS Graduate School of Engineering, Department of Chemistry and Chemical Engineering, Hiroshima University, Kagamiyama 1-4-1,

Higashi-Hiroshima,
739-8527, Japan

SO Journal of Catalysis (2004), 221(1), 43-54
CODEN: JCTLA5; ISSN: 0021-9517

PB Elsevier Science

DT Journal

LA English

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49, **51**

AB Spc-Ni/MgAl (spc: solid-phase crystallization method) catalysts have been prepared

from Mg-Al hydrotalcite-like compds. containing Ni at the Mg site as the

precursors and tested for partial oxidation of CH₄ into synthesis gas. The

precursors based on [Mg_{2+1-x}Al_{3+x}(OH)₂]_x(CO_{3-x})·mH₂O, in which a ratio of

Mg/Al varied and a part of the Mg²⁺ ions were replaced by Ni²⁺ ions, were

prepared by a copptn. method, thermally decomposed, and reduced to form

spc-Ni/MgAl catalyst. Surface areas of spc-Ni/MgAl catalysts were around

150 m² g⁻¹cat. Ni²⁺ ions first substituted a part of the Mg²⁺ sites in

the Mg-Al hydrotalcite-like compds. and then incorporated in the rock-salt-type Mg-Ni-O solid solns. in the mixed oxide after the decomposition

The dispersion of Ni was thus repeatedly enhanced during the spc preparation,

resulting in the highly dispersed Ni metal particles after the reduction. The

activity of the spc-Ni/MgAl catalyst was the highest at the ratio of Mg/Al

of 1/3. When the catalysts were tested in the partial oxidation of CH₄,

spc-Ni_{0.5}/Mg_{2.5}Al afforded enough high CH₄ conversion even at the high space velocity (9+10⁵ ml h⁻¹ g⁻¹cat); exceeding the value obtained over 1 wt% Rh/MgO. Ni species on spc-Ni_{0.5}/Mg_{2.5}Al catalysts were stable

even under the presence of O₂, while Ni catalysts prepared by the conventional impregnation quickly lost activity due to the surface oxidation

of Ni particles. Moreover, the total heat produced by the reaction was

the lowest over the spc-Ni_{0.5}/Mg_{2.5}Al catalyst among the catalysts tested.

This strongly suggests that the heat of **exothermic** CH₄ combustion to H₂O and CO₂ could be quickly consumed by the following **endothermic** CH₄ reforming by H₂O and CO₂ over spc-Ni_{0.5}/Mg_{2.5}Al. Thus, the spc-Ni_{0.5}/Mg_{2.5}Al catalyst is a hopeful candidate for the **autothermal** reforming of CH₄ which can be carried out under the copresence of both H₂O and O₂ to feed H₂ to the fuel cell economically. Actually the **autothermal** reforming of CH₄ has been successfully carried out over spc-Ni_{0.5}/Mg_{2.5}Al catalysts.

ST methane **autothermal** reforming catalyst hydrogen; partial oxidn methane synthesis gas

IT Reforming

Reforming catalysts

Synthesis gas manufacturing

(**autothermal** reforming of CH₄ over supported Ni catalysts prepared from Mg-Al hydrotalcite-like anionic clay)

IT Fuel cells

(hydrogen for; **autothermal** reforming of CH₄ over supported Ni catalysts prepared from Mg-Al hydrotalcite-like anionic clay in

relation

to)

IT Oxidation catalysts

(partial; **autothermal** reforming of CH₄ over supported Ni catalysts prepared from Mg-Al hydrotalcite-like anionic clay)

IT Crystallization

(solid-phase; **autothermal** reforming of CH₄ over supported Ni

IT catalysts prepared from Mg-Al hydrotalcite-like anionic clay)
7440-02-0, Nickel, uses

RL: **CAT (Catalyst use)**; USES (Uses)

(**autothermal** reforming of CH₄ over supported Ni catalysts prepared from Mg-Al hydrotalcite-like anionic clay)

IT 74-82-8, Methane, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(**autothermal** reforming of CH₄ over supported Ni catalysts prepared from Mg-Al hydrotalcite-like anionic clay)

IT **1333-74-0P**, Hydrogen, preparation

RL: **SPN (Synthetic preparation)**; **PREP (Preparation)**

(**autothermal** reforming of CH₄ over supported Ni catalysts prepared from Mg-Al hydrotalcite-like anionic clay)

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L60 ANSWER 18 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 140:238171 HCA

ED Entered STN: 01 Apr 2004

TI Thermodynamic and kinetic modelling of an **autothermal** methanol reformer

AU Chan, S. H.; Wang, H. M.

CS Fuel Cell Strategic Research Programme, School of Mechanical & Production

Engineering, S639798, Singapore

SO Journal of Power Sources (2004), 126(1-2), 8-15

CODEN: JPSODZ; ISSN: 0378-7753

PB Elsevier Science B.V.

DT Journal

LA English

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)

Section cross-reference(s): 49, 52, 67

AB This paper consists of two parts. First, a complete thermodyn. anal. of

autothermal methanol reforming over a wide range of air-fuel and **water**-fuel ratios is described. Second, a detailed description is given to the development of a 1D, non-steady, oxidative methanol reformer

model. Calcns. of the chemical equilibrium composition show that the predicted H₂

yield in the fuel-**water**-air reaction system is always lower than that obtained from experiment, while the predicted **CO** is always higher than that obtained from experiment. Corrections are made to the predicted results by incorporating a **water**-gas shift reaction, whereby the **CO** is oxidized by **water** to produce more H₂. With this correction, the predicted H₂ and **CO** yields are in good agreement with the exptl. results. Some preliminary results from the

kinetic model are also presented. The model considers the heat/mass transfer phenomena associated with the kinetics of the methanol reaction, and

is able to express the temporal and spatial variations of the temperature of the

catalyst, the concentration of the reactant gases, and the conversion efficiency

of methanol in the reformer.

ST **autothermal** methanol reformer thermodyn kinetic modeling
IT Reactors
 (packed-bed, catalytic; thermodyn. and kinetic modeling of an
 autothermal methanol reformer)
IT Heat
 (recovery; thermodyn. and kinetic modeling of an **autothermal**
 methanol reformer)
IT Reforming apparatus
 (steam; thermodyn. and kinetic modeling of an **autothermal**
 methanol reformer)
IT Fuel gas manufacturing
 (synthesis gas, partial oxidation, steam reforming; thermodyn. and
kinetic modeling of an **autothermal** methanol reformer)
IT Fuel cells
 Simulation and Modeling, physicochemical
 Thermodynamics
 Water gas shift reaction
 (thermodyn. and kinetic modeling of an **autothermal** methanol
 reformer)
IT 1314-13-2, Zinc oxide, uses 1317-38-0, Copper oxide, uses
1344-28-1,
 Alumina, uses
 RL: **CAT (Catalyst use)**; USES (Uses)
 (thermodyn. and kinetic modeling of an **autothermal** methanol
 reformer)
IT 124-38-9, **Carbon dioxide**, formation (nonpreparative)
7440-44-0, Carbon, formation (nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
 (thermodyn. and kinetic modeling of an **autothermal** methanol
 reformer)
IT 630-08-0, **Carbon monoxide**, reactions
RL: FMU (Formation, unclassified); RCT (Reactant); FORM (Formation,
nonpreparative); RACT (Reactant or reagent)
 (thermodyn. and kinetic modeling of an **autothermal** methanol
 reformer)
IT 67-56-1, Methanol, reactions 7732-18-5, **Water**, reactions
7782-44-7, **Oxygen**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
 (thermodyn. and kinetic modeling of an **autothermal** methanol
 reformer)
IT 1333-74-0P, Hydrogen, preparation
RL: **SPN (Synthetic preparation)**; **PREP (Preparation)**
 (thermodyn. and kinetic modeling of an **autothermal** methanol
 reformer)
RE.CNT 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD
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L60 ANSWER 19 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 138:387591 HCA

ED Entered STN: 12 Jun 2003

TI Process for catalytic **auto-thermal** steam reforming of higher alcohols, in particular **ethanol**

IN Wieland, Stefan; Baumann, Frank

PA Omg Ag & Co. Kg, Germany; Umicore AG & Co. Kg

SO Eur. Pat. Appl., 6 pp.

CODEN: EPXXDW

DT Patent

LA English

IC ICM C01B003-32

CC 49-10 (Industrial Inorganic Chemicals)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	EP 1314688	A2	20030528	EP 2002-26344	20021122
	EP 1314688	A3	20031217		
PT,	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC,				
	IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, SK				
	DE 10157155	A1	20030612	DE 2001-10157155	20011122
	US 2003116472	A1	20030626	US 2002-300173	20021120
	CA 2412328	AA	20030522	CA 2002-2412328	20021121
	JP 2003183002	A2	20030703	JP 2002-338654	20021121
	BR 2002004774	A	20030916	BR 2002-4774	20021122
PRAI	DE 2001-10157155	A	20011122		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
EP 1314688	ICM	C01B003-32
EP 1314688	ECLA	C01B003/32B
DE 10157155	ECLA	C01B003/32B
US 2003116472	ECLA	C01B003/32B

AB The invention relates to a process for catalytic **auto-thermal** steam reforming of alcs. having two or more carbon atoms (C_{≥2}) by directing an educt mixture of the alcs., **oxygen**

and **water** or steam, which is heated to a preheat temperature, over a catalyst. The process is wherein it is conducted in an adiabatic manner wherein the catalyst comprises, on a carrier, a coating of a catalyst composition comprising at least one platinum group metal on an oxidic support selected from the group consisting of aluminum oxide, silicon dioxide, titanium dioxide or mixed oxides thereof and zeolites, and that the educt mixture addnl. comprises hydrocarbons, which are reformed at the same time as the alcs.

ST **ethanol** catalytic **auto thermal** steam reforming **hydrogen** manuf

IT Alcohols, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(C2+; process for catalytic **auto-thermal** steam reforming of higher alcs., in particular **ethanol**)

IT Ceramics
(catalyst support; process for catalytic **auto-thermal** steam reforming of higher alcs., in particular **ethanol**)

IT Catalyst supports
(honeycomb, ceramic; process for catalytic **auto-thermal** steam reforming of higher alcs., in particular **ethanol**)

IT **Diesel** fuel
Steam
Steam reforming
Steam reforming catalysts
(process for catalytic **auto-thermal** steam reforming of higher alcs., in particular **ethanol**)

IT Alkali metal oxides
Alkaline earth oxides
Platinum-group metals
Rare earth oxides
Zeolites (synthetic), uses
RL: **CAT (Catalyst use)**; USES (Uses)
(process for catalytic **auto-thermal** steam reforming of higher alcs., in particular **ethanol**)

IT **Gasoline**
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(process for catalytic **auto-thermal** steam reforming of higher alcs., in particular **ethanol**)

IT 1303-86-2, Boric oxide, uses 1304-76-3, Bismuth oxide, uses
1306-38-3, Cerium oxide, uses 1312-81-8, Lanthanum oxide
1344-28-1, Alumina, uses 7440-05-3, Palladium, uses

7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses
7631-86-9, Silica, uses 12024-21-4, Gallium oxide 13463-67-7,
Titania,
uses
RL: CAT (Catalyst use); USES (Uses)
(process for catalytic **auto-thermal** steam reforming
of higher alcs., in particular **ethanol**)

IT 64-17-5, **Ethanol**, processes 74-82-8,
Methane, processes 124-38-9, **Carbon**
dioxide, processes 630-08-0, **Carbon**
monoxide, processes 7782-44-7, **Oxygen**,
processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical
process); PROC (Process)
(process for catalytic **auto-thermal** steam reforming
of higher alcs., in particular **ethanol**)

IT 1333-74-0P, **Hydrogen**, preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(process for catalytic **auto-thermal** steam reforming
of higher alcs., in particular **ethanol**)

L60 ANSWER 20 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 139:383868 HCA
ED Entered STN: 11 Dec 2003
TI **Hydrogen** generation by **methanol autothermal**
reforming in microchannel reactors
AU Chen, Guangwen; Yuan, Quan; Li, Shulian; Pillot, Christelle; Li,
Hengqiang
CS Dalian Institute of Chemical Physics, Chinese Academy of Sciences,
Dalian,
116023, Peop. Rep. China
SO American Institute of Chemical Engineers, [Spring National Meeting],
New
Orleans, LA, United States, Mar. 30-Apr. 3, 2003 (2003), 1939-1943
Publisher: American Institute of Chemical Engineers, New York, N. Y.
CODEN: 69DYXB
DT Conference; (computer optical disk)
LA English
CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 47, 51, 67
AB The miniaturization of a **hydrogen** source is the prerequisite of
its practical application of practical utilization of on-board
reforming
fuel cell technol. for automotive **propulsion**. Application of
micro chemical technol. may improve greatly the efficiency of systems
and
diminish their vols. and wts., especially integration of microchannel
reactor

system and heat exchanger systems. A microchannel reactor system was made

by chemical etching on stainless steel (SS) and aluminum (Al) chips, containing

48:1.1 and 38:2.4 microchannels:ml resp. CeO₂-ZrO₂ wash-coats were deposited, and a platinum catalyst solution dip-coated, calcined, and reduced

with **hydrogen**. The same composition of catalyst in a ceramic monolith reactor was prepared for the purpose of comparing with the microreactor. **Methanol autothermal** reforming was performed with **water, oxygen**, air, and **methanol**, forming the usually product gas stream of **H₂**, **CO₂**, **CO** and **CH₄** as well as unreacted **CH₃OH** and **H₂O**. More feed **oxygen** and higher reaction temps. were favored for highest conversion, **but** created the most **CO**

. Increased mass and heat transfer in the microchannel reactor enabled

greatly increased reaction and **hydrogen** production rates compared to the ceramic monolith reactor, with product composition relatively unchanged

over a wide range of gas hourly space velocities.

ST **hydrogen methanol autothermal** steam reforming catalyst microchannel micro reactor

IT Steam reforming
Steam reforming catalysts

(**hydrogen** generation by **methanol autothermal** reforming in microchannel reactors)

IT Reactors
(microreactors, microchannel; **hydrogen** generation by **methanol autothermal** reforming in microchannel reactors)

IT Ceramics
(substrates, monolith catalyst/reactor; **hydrogen** generation by **methanol autothermal** reforming in microchannel reactors).

IT 1306-38-3, Cerium oxide (CeO₂), uses 1314-23-4, Zirconium oxide (ZrO₂), uses

RL: **CAT (Catalyst use)**; USES (Uses)
(**hydrogen** generation by **methanol autothermal** reforming in microchannel reactors)

IT 7440-06-4P, Platinum, uses
RL: **CAT (Catalyst use)**; SPN (Synthetic preparation); PREP (Preparation); USES (Uses)

(**hydrogen** generation by **methanol autothermal** reforming in microchannel reactors)

IT 7429-90-5, Aluminum, uses 12597-68-1, Stainless steel, uses
RL: CPS (Chemical process); DEV (Device component use); PEP (Physical, engineering or chemical process); TEM (Technical or engineered material)

use); PROC (Process); USES (Uses)
 (hydrogen generation by **methanol**
 autothermal reforming in microchannel reactors)
IT 74-82-8, **Methane**, formation (nonpreparative)
124-38-9, **Carbon dioxide**, formation
 (nonpreparative) 630-08-0, **Carbon monoxide**,
 formation (nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
 (hydrogen generation by **methanol**
 autothermal reforming in microchannel reactors)
IT 1333-74-0P, **Hydrogen**, preparation
RL: IMF (**Industrial manufacture**); RCT (Reactant); PREP
 (**Preparation**); RACT (Reactant or reagent)
 (hydrogen generation by **methanol**
 autothermal reforming in microchannel reactors)
IT 7782-44-7, **Oxygen**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
 (hydrogen generation by **methanol**
 autothermal reforming in microchannel reactors)
IT 67-56-1, **Methanol**, uses
RL: RCT (Reactant); TEM (Technical or engineered material use); RACT
 (Reactant or reagent); USES (Uses)
 (hydrogen generation by **methanol**
 autothermal reforming in microchannel reactors)

RE.CNT 6 THERE ARE 6 CITED REFERENCES AVAILABLE FOR THIS RECORD
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1999,
P1

L60 ANSWER 21 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 140:184304 HCA
ED Entered STN: 11 Mar 2004
TI Reaction mechanism of partial oxidation of **methane** to synthesis
gas over supported Ni catalysts
AU Kim, Sang-Bum; Kim, Young-Kook; Lim, Yun-Su; Kim, Myung-Soo; Hahm,
Hyun-Sik
CS Division of Ceramic and Chemical Engineering, Myongji University,
Yongin,
449-728, S. Korea
SO Korean Journal of Chemical Engineering (2003), 20(6), 1023-1025
CODEN: KJCHE6; ISSN: 0256-1115
PB Korean Institute of Chemical Engineers

DT Journal
LA English
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
AB A mechanistic study on the partial oxidation of **methane** to synthesis gas (**H2** and **CO**) was conducted with supported nickel catalysts. To investigate the reaction mechanism, pulse expts., **O2**-TPD, and a comparison of the moles of reactants and products were carried out. From the **O2**-TPD experiment, the active catalyst in the synthesis gas production desorbed **oxygen** at a lower temperature
In the pulse experiment, the temperature of the top of the catalyst bed increased with the pulses, whereas the temperature of the bottom decreased. This suggests that there are two kinds of reactions, i.e., the total oxidation of **methane** (**exothermic**) at the top and reforming reactions (**endothermic**) at the bottom. From the comparison of the moles of reactants and products, the moles of **CO2**, **CH4** and **H2O** decreased as the moles of **H2** and **CO** increased. The results support the mechanism that synthesis gas is produced through a two-step reaction mechanism: the total oxidation of **methane** to **CO2** and **H2O** takes place first, followed by the reforming reaction of the produced **CO2** and **H2O** with residual **CH4** to form synthesis gas.
ST reaction mechanism partial oxidn **methane** synthesis gas nickel catalyst
IT Synthesis gas manufacturing
(partial oxidation; reaction mechanism of partial oxidation of **methane** to synthesis gas over supported Ni catalysts)
IT Oxidation catalysts
(partial; reaction mechanism of partial oxidation of **methane** to synthesis gas over supported Ni catalysts)
IT 1304-28-5, Barium oxide, uses 1305-78-8, Calcia, uses 1309-48-4, Magnesia, uses 7440-02-0, Nickel, uses
RL: **CAT (Catalyst use)**; **USES (Uses)**
(reaction mechanism of partial oxidation of **methane** to synthesis gas over supported Ni catalysts)
IT 74-82-8, **Methane**, reactions
RL: **RCT (Reactant)**; **RACT (Reactant or reagent)**
(reaction mechanism of partial oxidation of **methane** to synthesis gas over supported Ni catalysts)
RE.CNT 23 THERE ARE 23 CITED REFERENCES AVAILABLE FOR THIS RECORD
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L60 ANSWER 22 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 141:280256 HCA

ED Entered STN: 14 Oct 2004

TI Modeling of an **autothermal** methanol reformer

AU Chan, S. H.; Wang, H. M.; Ho, H. K.

CS Fuel Cell Strategic Research Programme, School of Mechanical & Production

Engineering, Nanyang Technological University, Singapore, 639798, Singapore

SO Hydrogen Planet, World Hydrogen Energy Conference, 14th, Montreal, QC, Canada, June 9-13, 2002 (2003), Meeting Date 2002, 734-744 Publisher: Canadian Hydrogen Association, Montreal, Que.
CODEN: 69FMBV

DT Conference; (computer optical disk)

LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49, **51**, 67

AB This paper describes the development of a 1-D, unsteady, oxidative methanol reformer model. The model considers the heat and mass transfer

phenomena associated with the kinetics of methanol reaction and is able to

express the temporal and spatial variations of the temperature of catalyst,

concentration of the reactant gases and conversion efficiency of the methanol in the reformer.

ST **autothermal** methanol reformer modeling

IT Reactors
(fixed-bed, catalytic; modeling of **autothermal** methanol reformer)

IT Combustion
Electric vehicles
Oxidation
(modeling of **autothermal** methanol reformer)

IT Fuel cells
(on-board; modeling of **autothermal** methanol reformer)

IT Synthesis gas manufacturing
(steam reforming synthesis gas manufacturing; modeling of autothermal methanol reformer)

IT Reforming apparatus
(steam; modeling of **autothermal** methanol reformer)

IT 1314-13-2, Zinc oxide (ZnO), uses 1317-38-0, Copper oxide (CuO), uses 1344-28-1, Alumina, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(modeling of **autothermal** methanol reformer)

IT 124-38-9, **Carbon dioxide**, processes
RL: CPS (Chemical process); FMU (Formation, unclassified); PEP (Physical, engineering or chemical process); FORM (Formation, nonpreparative); PROC (Process)
(modeling of **autothermal** methanol reformer)

IT 67-56-1, Methanol, uses 7727-37-9, Nitrogen, uses 7732-18-5, **Water**, uses 7782-44-7, **Oxygen**, uses
RL: CPS (Chemical process); NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(modeling of **autothermal** methanol reformer)

IT **1333-74-0P**, Hydrogen, preparation
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); **SPN (Synthetic preparation)**; **PREP (Preparation)**; PROC (Process)
(modeling of **autothermal** methanol reformer)

RE.CNT 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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- L60 ANSWER 23 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 139:182756 HCA
ED Entered STN: 11 Sep 2003
TI Ultra rapid reforming of hydrocarbons by **thermo-neutral**
reaction method on a multi-functional catalyst for **hydrogen**
production and fuel cell systems
AU Inui, Tomoyuki
CS Air Water Inc., 6-40, Chiko Shinmachi, 2-Cho, Sakai, Osaka, 592-8331,
Japan
SO Preprints of Symposia - American Chemical Society, Division of Fuel
Chemistry (2003), 48(1), 370-373
CODEN: PSADFZ; ISSN: 1521-4648
PB American Chemical Society, Division of Fuel Chemistry
DT Journal
LA English
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **51**
AB A combined **thermo-neutral** process for **CO2**
reforming or steam reforming of **natural gas** (e.g.,
consisting of simultaneous CH4 conversion with combustion of
C2-4-hydrocarbons) was characterized by a (100:20:3:1 atomic ratio)
Ni-Ce2O3-Pt-Rh composite catalyst supported on a ceramic fiber,
cordierite
honeycomb, or high-temperature calcined alumina spheres. The
process, which can
be extended to steam reforming of LPG and city gas, can also
incorporate a
water gas shift unit for production of addnl. **H2** from
CO. With close control of bed temperature and **oxygen** concentration
in the feed gases, a good balance can be attained between
exothermic combustion and **endothermic** reforming,
resulting in a high **hydrogen** production with minimal **H2**
losses due to **H2** and **CO** combustion. The main product
(**H2**) can be used to power a fuel cell.
ST hydrocarbon reforming **thermoneutral** reaction multifunctional
catalyst **hydrogen** fuel cell; nickel cerium platinum rhodium
hydrocarbon reforming
IT Hydrocarbons, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical
process); PROC (Process)
(C2-4, combustion of; ultrarapid reforming of hydrocarbons to fuel
cell-grade **hydrogen** by **thermo-neutral**
combination of combustion and reforming over Ni-Ce2O3-Pt-Rh
multifunctional catalyst)

- IT Fuel gases
(city gas, reforming of; ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT **Petroleum** products
(gases, liquefied, reforming of; ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT Fuel cells
(polymer-electrolyte; ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT Fuel gas manufacturing
(reforming, with **carbon dioxide**; ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT Fuel gas manufacturing
(steam reforming; ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT Combustion catalysts
Water gas shift reaction
(ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT **Natural gas**, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)
(ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT 1345-13-7, Cerium oxide (Ce2O3) **7440-02-0**, Nickel, uses **7440-06-4**, Platinum, uses **7440-16-6**, Rhodium, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(catalysts; ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)
- IT **124-38-9, Carbon dioxide**, processes

RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)

(hydrocarbon reforming in presence of; ultrarapid reforming of hydrocarbons to fuel cell-grade **hydrogen** by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)

IT 1333-74-0P, **Hydrogen**, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)

(manufacture of; ultrarapid reforming of hydrocarbons to fuel cell-grade

hydrogen by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)

IT 74-82-8, **Methane**, processes

RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)

(reforming of; ultrarapid reforming of hydrocarbons to fuel cell-grade

hydrogen by **thermo-neutral** combination of combustion and reforming over Ni-Ce2O3-Pt-Rh multifunctional catalyst)

RE.CNT 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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1996, V634, P186 HCA

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L60 ANSWER 24 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 137:265379 HCA

ED Entered STN: 24 Oct 2002

TI Generation of **hydrogen** by fuel reforming for fuel cells

IN Ahmed, Shabbir; Krumpelt, Michael

PA University of Chicago, USA

SO PCT Int. Appl., 26 pp.

CODEN: PIXXD2

DT Patent

LA English

IC ICM C01B003-02

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)

Section cross-reference(s): 52, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2002076882	A2	20021003	WO 2002-US3690	20020207
	WO 2002076882	A3	20030403		
	W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH,				
CN,	CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE,				
GH,	GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK,				
LR,	LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM,				
PH,	PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT,				
TZ,	UA, UG, US, UZ, VN, YU, ZA, ZM, ZW				
BY,	RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ,				
GB,	KG, KZ, MD, RU, TJ, TM, AT, BE, CH, CY, DE, DK, ES, FI, FR,				
GA,	GR, IE, IT, LU, MC, NL, PT, SE, TR, BF, BJ, CF, CG, CI, CM,				
	GN, GQ, GW, ML, MR, NE, SN, TD, TG				
	US 2002174603	A1	20021128	US 2001-816694	20010323
PRAI	US 2001-816694	A	20010323		

CLASS

	PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
	WO 2002076882	ICM	C01B003-02
	US 2002174603	ECLA	C01B003/32B2; C01B003/38A; C01B003/38D; C01B003/40
AB	<p>A H2-rich gas is generated by reforming a fuel mixture consisting of mol. oxygen (air), fuel, and water in the presence of an autothermally reforming catalyst at 400-700°C. The fuel can be methane, natural gas, propane, ethanol, liquefied petroleum gas, gasoline, kerosene, and diesel. The catalyst contains a transition metal, such as Pt, Pd, Ru, Rh, Ir, Fe, Co, Ni, Cu, Ag, or Au and an oxide ion-conducting ceramic material crystallized in</p> <p>a fluorite structure or LaGaO3. The obtained H2-rich gas is brought into contact with a second catalyst to convert CO and H2O into CO2 and H2. The second catalyst consists of a transition metal, such as Pt, Pd, Ni, Ir, Rh, Co, Cu, Ag, Au, Ru, or Fe, on ceria or ceria doped with a rare earth or alkaline</p> <p>earth element, such as Gd, Sm, Y, La, Pr, Mg, Ca, Sr, or Ba.</p>		

- ST **hydrogen** manuf hydrocarbon fuel reforming catalyst fuel cell
IT **Natural gas**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(fuel; generation of **hydrogen** by fuel reforming for fuel cells)
- IT **Petroleum** products
(gases, liquefied, fuel; generation of **hydrogen** by fuel reforming for fuel cells)
- IT **Diesel** fuel
Fuel cells
Reforming catalysts
(generation of **hydrogen** by fuel reforming for fuel cells)
- IT **Gasoline**
Kerosene
RL: RCT (Reactant); RACT (Reactant or reagent)
(generation of **hydrogen** by fuel reforming for fuel cells)
- IT Fuel gas manufacturing
(reforming; generation of **hydrogen** by fuel reforming for fuel cells)
- IT 7439-91-0, Lanthanum, uses 7439-95-4, Magnesium, uses 7440-10-0, Praseodymium, uses 7440-19-9, Samarium, uses 7440-24-6, Strontium, uses 7440-39-3, Barium, uses 7440-54-2, Gadolinium, uses 7440-65-5, Yttrium, uses 7440-70-2, Calcium, uses
RL: CAT (Catalyst use); MOA (Modifier or additive use); USES (Uses)
(dopant; generation of **hydrogen** by fuel reforming for fuel cells)
- IT 64-17-5, Ethanol, reactions 67-63-0, Iso-propanol, reactions 71-23-8, n-Propanol, reactions 71-43-2, Benzene, reactions 74-82-8, Methane, reactions 74-84-0, Ethane, reactions 74-85-1, Ethylene, reactions 74-98-6, Propane, reactions 106-97-8, Butane, reactions 108-88-3, Toluene, reactions 109-66-0, Pentane, reactions 110-54-3, Hexane, reactions 110-82-7, Cyclohexane, reactions 115-07-1, Propene, reactions 287-92-3, Cyclopentane 540-84-1, Iso-octane 1330-20-7, Xylene, reactions 25167-67-3, Butene 25377-72-4, Pentene 35296-72-1, Butanol
RL: RCT (Reactant); RACT (Reactant or reagent)
(fuel; generation of **hydrogen** by fuel reforming for fuel cells)
- IT 1306-38-3, Ceria, uses 7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-18-8, Ruthenium, uses

7440-22-4, Silver, uses 7440-48-4, Cobalt, uses
7440-50-8, Copper, uses 7440-57-5, Gold, uses
12160-53-1, Gallium lanthanum oxide galao3
RL: CAT (Catalyst use); USES (Uses)
(generation of **hydrogen** by fuel reforming for fuel cells)

IT 124-38-9, Carbon dioxide, formation
(nonpreparative)
RL: FMU (Formation, unclassified); FORM (Formation, nonpreparative)
(generation of **hydrogen** by fuel reforming for fuel cells)

IT 1333-74-0P, Hydrogen, preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(generation of **hydrogen** by fuel reforming for fuel cells)

IT 630-08-0, Carbon monoxide, reactions
7732-18-5, Water, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(generation of **hydrogen** by fuel reforming for fuel cells)

L60 ANSWER 25 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 136:216387 HCA
ED Entered STN: 28 Mar 2002
TI Mechanism for the Formaldehyde to Formic Acid and the Formic Acid to
Carbon Dioxide Conversions Mediated by an Iron-Oxo
Species
AU Yumura, Takashi; Amenomori, Tatsuhiko; Kagawa, Yoshihisa; Yoshizawa,
Kazunari
CS Institute for Fundamental Research of Organic Chemistry, Kyushu
University, Fukuoka, 812-8581, Japan
SO Journal of Physical Chemistry A (2002), 106(4), 621-630
CODEN: JPCAFH; ISSN: 1089-5639
PB American Chemical Society
DT Journal
LA English
CC 22-7 (Physical Organic Chemistry)
Section cross-reference(s): 67
AB The mechanism and energetics for the formaldehyde to formic acid and
the
formic acid to C dioxide conversions are studied using the FeO+
complex as
an oxidant from theor. calcns. at the B3LYP DFT level. In the
oxidation
processes, there are a lot of reaction branches which are comparable
in
energy. The elementary processes can be viewed as C-H and O-H
cleavage
reactions by oxo and hydroxo ligands as well as OH group migrations.
In
formaldehyde oxidation, the initially formed complex OFe+-OCH2 is
converted

by a C-H bond cleavage to intermediate HO-Fe+-OCH, which is next transformed to the formic acid complex Fe+-OCHOH by an OH ligand migration and to the C monoxide complex **H2O-Fe+-CO** by a C-H bond cleavage. There are two possible reaction pathways for the formic acid to C dioxide conversion, both reaction pathways being downhill and highly **exothermic**. In an energetically favorable reaction pathway, complex OFe+-OCHOH is first converted to intermediate HO-Fe+-OCHO by an O-H bond cleavage, and after that, HO-Fe+-OCHO is transformed to the product complex **H2O-Fe+-O2C** by a C-H bond cleavage. Formaldehyde and formic acid are easily oxidized by an excess of oxidants to C dioxide and C monoxide. The overall reaction from **methane** to C dioxide is **exothermic** by 117.9 kcal/mol, and there is no high barrier after **methanol** formation, which can cause the known overoxidn. problem in **methane** and alkane oxidation. Calcns. are in good agreement with previous expts. on **methane** oxidation over Fe-ZSM-5 zeolite with respect to the product branching ratio, suggesting that a surface Fe-oxo species should have relevance to the interesting catalytic functions of Fe-ZSM-5 zeolite.

ST mechanism formaldehyde oxidn iron oxo species; **carbon dioxide** formation MO; formic acid decarboxylation mechanism MO iron oxo species

IT Density functional theory
(B3LYP; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Electron density
(Mulliken; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT HOMO (molecular orbital)
LUMO (molecular orbital)
(**carbon dioxide**; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Bond
(carbon-**hydrogen**, activation; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Bond cleavage
(carbon-**hydrogen**; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions)

mediated by iron-oxo species)

IT Activation energy
(**hydrogen** abstraction; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Bond cleavage
(**hydrogen oxygen**; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Abstraction reaction
(**hydrogen**; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Isomerization
(hydroxyl group migration; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Bond length
Combustion
Combustion enthalpy
Electron spin density
Hydroxyl group
Oxidation
Oxidation enthalpy
Oxidizing agents
Potential barrier
Potential energy hypersurface
Reaction enthalpy
Transition state structure
(mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Carbonyl compounds (organic), reactions
RL: CPS (Chemical process); FMU (Formation, unclassified); PEP (Physical, engineering or chemical process); PRP (Properties); RCT (Reactant); FORM (Formation, nonpreparative); PROC (Process); RACT (Reactant or reagent)
(mechanistic reaction intermediate iron; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT Dehydration catalysts
Dehydration reaction
(model for formic acid; mechanism for formaldehyde to formic acid and

formic acid to **carbon dioxide** conversions mediated
by iron-oxo species)

IT Zeolite ZSM-5
RL: **CAT (Catalyst use)**; CPS (Chemical process); PEP (Physical,
engineering or chemical process); PROC (Process); USES (Uses)
(model for ion; mechanism for formaldehyde to formic acid and
formic acid to **carbon dioxide** conversions mediated by
iron-oxo species)

IT Combustion catalysts
Oxidation catalysts
(model for; mechanism for formaldehyde to formic acid and formic
acid to **carbon dioxide** conversions mediated by iron-oxo
species)

IT Molecular structure
(optimized; mechanism for formaldehyde to formic acid and formic
acid to **carbon dioxide** conversions mediated by iron-oxo
species)

IT Electronic state
(quartet; mechanism for formaldehyde to formic acid and formic
acid to **carbon dioxide** conversions mediated by iron-oxo
species)

IT Energy level
(sextet; mechanism for formaldehyde to formic acid and formic acid
to **carbon dioxide** conversions mediated by iron-oxo
species)

IT Reaction mechanism
(surface, model for; mechanism for formaldehyde to formic acid and
formic acid to **carbon dioxide** conversions mediated
by iron-oxo species)

IT 12434-84-3
RL: **CAT (Catalyst use)**; CPS (Chemical process); PEP (Physical,
engineering or chemical process); PRP (Properties); RCT (Reactant);
PROC (Process); RACT (Reactant or reagent); USES (Uses)
(catalyst model; mechanism for formaldehyde to formic acid and
formic acid to **carbon dioxide** conversions mediated by
iron-oxo species)

IT 50-00-0, Formaldehyde, reactions 64-18-6, Formic Acid, reactions
RL: CPS (Chemical process); FMU (Formation, unclassified); PEP
(Physical,
engineering or chemical process); PRP (Properties); RCT (Reactant);
FORM

(Formation, nonpreparative); PROC (Process); RACT (Reactant or reagent)

(mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT 74-82-8, **Methane**, reactions

RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PRP (Properties); RCT (Reactant); PROC (Process); RACT (Reactant

or reagent)

(mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT 124-38-9, **Carbon dioxide**, properties

630-08-0, **Carbon monoxide**, properties

14067-02-8, Iron, ion(Fe+), **properties**

RL: FMU (Formation, unclassified); PRP (Properties); FORM (Formation, nonpreparative)

(mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT 16499-21-1, **Formyloxyl radical** 78944-70-4, **Formic acid**, ion(1-), **properties**

RL: PRP (Properties)

(mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

IT 124-38-9D, **Carbon dioxide**, complex of

monohydrated iron monocation with 112374-38-6 126492-96-4D, Iron(1+),

aqua, complex of **carbon dioxide** with monohydrate

138259-33-3 138259-34-4 157177-19-0 209623-05-2 303730-95-2

303730-96-3 303730-97-4 303730-99-6 402573-12-0 402573-13-1

402573-14-2 402573-15-3 402573-16-4 402573-17-5 402573-18-6

402573-19-7

RL: **CAT (Catalyst use)**; CPS (Chemical process); FMU (Formation, unclassified); PEP (Physical, engineering or chemical process); PRP (Properties); RCT (Reactant); FORM (Formation, nonpreparative); PROC (Process); RACT (Reactant or reagent); USES (Uses)

(mechanistic reaction intermediate catalyst model; mechanism for formaldehyde to formic acid and formic acid to **carbon dioxide** conversions mediated by iron-oxo species)

RE.CNT 59 THERE ARE 59 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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L60 ANSWER 26 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 139:325648 HCA

ED Entered STN: 13 Nov 2003

TI Oxy-**CO2** reforming and oxy-**CO2** steam reforming of **methane** to syngas over CoxNi1-xO/MgO/SA-5205

AU Choudhary, V. R.; Mamman, A. S.; Uphade, B. S.

CS Chemical Engineering Division, National Chemical Laboratory, Pune, 411008,

India

SO Environmental Challenges and Greenhouse Gas Control for Fossil Fuel Utilization in the 21st Century, [Based on the Symposia "Environmental Challenges for Fossil Fuel Combustion" and "Greenhouse Gas Control and Utilization" held at the American Chemical Society National Meeting],

San

Diego, CA, United States, Apr. 1-5, 2001 (2002), Meeting Date 2001, 299-312. Editor(s): Maroto-Valer, M. Mercedes; Song, Chunshan; Soong, Yee. Publisher: Kluwer Academic/Plenum Publishers, New York, N. Y. CODEN: 69EAXC; ISBN: 0-306-47336-4

DT Conference

LA English

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 67

AB Oxy-**CO2** reforming and simultaneous oxy-**CO2** and steam reforming of **methane**, involving coupling of **exothermic** oxidative conversion and **endothermic** steam and/or **CO2** reforming of **methane** over CoxNi1-xO (14 ± 0.5 wt%)/MgO (7.6 wt%)/SA-5205 (x = 0.0 - 0.5) catalysts (where SA-5205 is a sintered

low

from

surface area macroporous silica-alumina catalyst carrier, obtained

Norton, USA) have been thoroughly investigated. Effect of **Co**/Ni ratio of the catalyst on its performance in these two **methane** -to-syngas conversion processes has been studied. For the oxy-**CO2** reforming process, the **Co**/Ni ratio has a strong influence on the conversion of **methane** and **CO2** and also on the selectivity for **H2**. The optimum **Co**/Ni ratio for this process was found to be 0.17. However, for the simultaneous oxy-**CO2** and steam reforming process, **Co**/Ni ratio has a

strong influence on the conversion of **CO2** and **H2O**, depending upon the process conditions, **but** has a little or no influence on the **methane** conversion and the **H2/CO** ratio. Hence, in this process, the catalyst with **Co/Ni** ratio of 1.0, which has lower activity for the filamental carbon formation, is more preferable. In this process (at 850°C), the catalyst (with **Co/Ni** = 1.0) shows very high **methane** conversion activity (97% conversion) and 100% selectivity (based on **methane**) for both **CO** and **H2** at a low contact time (15 ms) and the **H2/CO** ratio can be controlled by manipulating the **CO2/H2O** feed ratio. In both the processes, the **exothermic** oxidative conversion and **endothermic** steam and/or **CO2** reforming reactions over the catalyst occur simultaneously, involving coupling of the **exothermic** and **endothermic** reactions. Because of this, these processes are highly energy efficient and also non-hazardous or safe to operate. Moreover, by manipulating the process conditions [viz., temperature and **CH4/O2** feed ratio], these processes can be made mildly **endothermic**, near **thermoneutral** or mildly **exothermic**.

ST **carbon dioxide methane** reforming catalyst
cobalt nickel oxide magnesia

IT Reforming catalysts
Steam reforming catalysts
Synthesis gas

(oxy-**CO2** reforming and oxy-**CO2** steam reforming of **methane** to syngas over CoxNil-xO/MgO/SA-5205)

IT 1309-48-4, Magnesia, uses 112839-05-1, Cobalt nickel oxide ((**Co**,Ni)O)

RL: **CAT (Catalyst use)**; USES (Uses)

(oxy-**CO2** reforming and oxy-**CO2** steam reforming of **methane** to syngas over CoxNil-xO/MgO/SA-5205)

IT **74-82-8, Methane**, processes **124-38-9**,

Carbon dioxide, processes

RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process)

(oxy-**CO2** reforming and oxy-**CO2** steam reforming of **methane** to syngas over CoxNil-xO/MgO/SA-5205)

RE.CNT 27 THERE ARE 27 CITED REFERENCES AVAILABLE FOR THIS RECORD

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L60 ANSWER 27 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 134:368585 HCA
ED Entered STN: 14 Jun 2001
TI Extended catalyst life Fischer-Tropsch process
IN Beer, Gary L.; Leahy, James F.; Lisewsky, Greg A.; McHugh, Kernan J.;
Briscoe, Michael D.
PA Syntroleum Corporation, USA
SO U.S., 5 pp.
CODEN: USXXAM
DT Patent
LA English
IC ICM C07C027-00
NCL 518709000
CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)
Section cross-reference(s): 48, 51, 67

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 6239184	B1	20010529	US 1999-401420	19990922
PRAI	US 1999-401420		19990922		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
US 6239184	ICM	C07C027-00
	NCL	518709000

AB A process for extending the life of a Fischer-Tropsch catalyst comprises

converting synthesis gas, produced in an **autothermal** reactor by the substoichiometric oxidation of a light hydrocarbon gas, by removing ammonia from the synthesis gas prior to passing the synthesis gas to a Fischer-Tropsch reactor. A process flow diagram is presented.

ST Fischer Tropsch process catalyst life extended; ammonia removal Fischer Tropsch process catalyst life extended; hydrocarbon manuf Fischer Tropsch process catalyst life extended

IT Acids, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(ammonia removal from synthesis gas by contact with aqueous solns. of)

IT Fischer-Tropsch catalysts
(extended catalyst life Fischer-Tropsch process)

IT Synthesis gas
(extended catalyst life Fischer-Tropsch process with synthesis gas manufacture by oxidation of light hydrocarbons)

IT Hydrocarbons, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(light; extended catalyst life Fischer-Tropsch process with synthesis gas manufacture by oxidation of)

IT Hydrocarbons, preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(liquid; extended catalyst life Fischer-Tropsch process for manufacture of)

IT Group IIIA element oxides
Group IIIB element oxides
Group IVB element oxides
Group VB element oxides
Group VIB element oxides
Group VIII element oxides
RL: **CAT (Catalyst use)**; USES (Uses)
(supports; extended catalyst life Fischer-Tropsch process)

IT 7440-18-8, Ruthenium, uses 7440-48-4, Cobalt, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(extended catalyst life Fischer-Tropsch process)

IT 630-08-0P, **Carbon monoxide**, preparation
1333-74-0P, Hydrogen, preparation
RL: **IMF (Industrial manufacture)**; RCT (Reactant); **PREP (Preparation)**; RACT (Reactant or reagent)
(extended catalyst life Fischer-Tropsch process)

IT 124-38-9, **Carbon dioxide**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(extended catalyst life Fischer-Tropsch process with ammonia removal

- from synthesis gas by contact with aqueous solns. of)
- IT 7664-41-7, Ammonia, reactions
RL: RCT (Reactant); REM (Removal or disposal); PROC (Process); RACT (Reactant or reagent)
(extended catalyst life Fischer-Tropsch process with removal from synthesis gas of)
- IT 7782-44-7, **Oxygen**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(extended catalyst life Fischer-Tropsch process with synthesis gas manufacture by light hydrocarbon oxidation with)
- IT 7732-18-5P, **Water**, preparation
RL: BYP (Byproduct); RCT (Reactant); REM (Removal or disposal); PREP (Preparation); PROC (Process); RACT (Reactant or reagent)
(in an extended catalyst life Fischer-Tropsch process)
- IT 7440-15-5, Rhenium, uses 7440-32-6, Titanium, uses 7440-45-1, Cerium, uses 7440-58-6, Hafnium, uses 7440-61-1, Uranium, uses 7440-67-7, Zirconium, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(promoter; extended catalyst life Fischer-Tropsch process)
- IT 7631-86-9, Silica, uses 13463-67-7, Titania, uses 159995-97-8, Aluminum silicon oxide
RL: **CAT (Catalyst use)**; USES (Uses)
(support; extended catalyst life Fischer-Tropsch process)

RE.CNT 19 THERE ARE 19 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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- (18) Vannice; US 4171320 1979 HCA
- (19) Waycuilis; US 5861441 1999 HCA

AN 135:95027 HCA
 ED Entered STN: 02 Aug 2001
 TI Palladium-based metal-promoted catalysts for partial oxidation-steam reforming of methanol to hydrogen
 IN Kaneko, Hiroaki; Haga, Fumihiro
 PA Nissan Motor Co., Ltd., Japan
 SO Ger. Offen., 12 pp.
 CODEN: GWXXBX

DT Patent
 LA German

IC ICM B01J023-60
 ICS B01J023-63; H01M008-06

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	DE 10062578	A1	20010705	DE 2000-10062578	20001215
	JP 2001232197	A2	20010828	JP 2000-368626	20001204
	US 2001021469	A1	20010913	US 2000-735913	20001214
PRAI	JP 1999-356633	A	19991215		
	JP 2000-368626	A	20001204		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
DE 10062578	ICM	B01J023-60
	ICS	B01J023-63; H01M008-06

AB A methanol steam reforming-partial oxidation catalyst for production of a

hydrogen-containing product (reformed) fuel gas from methanol in the presence

of **oxygen** and **water** vapor consists of Pd, Zr, Zn, and/or Ce oxides impregnated onto a metal oxide support. Upon reduction at

400-600°, the catalyst incorporates a Pd-Zn or Pd-Zr alloy onto the support. The steam reforming-partial oxidation reaction accelerates the

steam reforming step (as the **endothermic** component) and the partial oxidation step (as the **exothermic** component), and decreasing the formation of CO(g), thus decreasing the need for supplemental heating.

ST steam reforming partial oxidn methanol hydrogen; palladium cerium methanol

reforming hydrogen; zinc zirconium palladium methanol reforming hydrogen

IT Fuel gas manufacturing

(steam reforming, partial oxidation-steam reforming; palladium-based

metal-promoted catalysts for partial oxidation-steam reforming of methanol

to hydrogen)
IT 1306-38-3, Cerium oxide, uses 1314-08-5, Palladium oxide
1314-13-2,
Zinc oxide (ZnO), uses 1314-23-4, Zirconium oxide (ZrO2), uses
7440-05-3, Palladium, uses 7440-45-1, Cerium, uses 7440-66-6,
Zinc,
uses 7440-67-7, Zirconium, uses 75882-74-5 151085-84-6
349083-55-2
RL: **CAT (Catalyst use)**; RCT (Reactant); RACT (Reactant or
reagent); USES (Uses)
(catalysts; palladium-based metal-promoted catalysts for partial
oxidation-steam reforming of methanol to hydrogen)
IT **1333-74-0P**, Hydrogen, preparation
RL: **IMF (Industrial manufacture)**; **PREP (Preparation)**
(manufacture of; palladium-based metal-promoted catalysts for
partial
oxidation-steam reforming of methanol to hydrogen)
IT 67-56-1, Methanol, reactions
RL: PEP (Physical, engineering or chemical process); RCT (Reactant);
PROC
(Process); RACT (Reactant or reagent)
(palladium-based metal-promoted catalysts for partial
oxidation-steam
reforming of methanol to hydrogen)

L60 ANSWER 29 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN
AN 2001-536631 [59] WPIX
DNC C2001-159807
TI Production of **hydrogen** and **carbon monoxide**
from **methane** and/or **ethane** or **butane** and
propane comprises catalytic partial oxidation of the hydrocarbon
under specified conditions.
DC E36 H04
IN ARPENTINIER, P; GARY, D; MILLET, C
PA (AIRL) AIR LIQUIDE SA; (ARPE-I) ARPENTINIER P; (GARY-I) GARY D;
(MILL-I)
MILLET C
CYC 95
PI WO 2001062662 A1 20010830 (200159)* FR 25 C01B003-38
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW
MZ
NL OA PT SD SE SL SZ TR TZ UG ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK
DM
DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ
LC
LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD
SE

SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
 FR 2805531 A1 20010831 (200159) C01B003-38
 AU 2001035744 A 20010903 (200202) C01B003-38
 EP 1259458 A1 20021127 (200302) FR C01B003-38
 R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL

PT

RO SE SI TR
 US 2003009943 A1 20030116 (200308) C01B003-38
 CN 1406207 A 20030326 (200344) C01B003-38
 JP 2003531795 W 20031028 (200373) 29 C01B003-36

ADT WO 2001062662 A1 WO 2001-FR519 20010222; FR 2805531 A1 FR 2000-2309
 20000224; AU 2001035744 A AU 2001-35744 20010222; EP 1259458 A1 EP
 2001-907875 20010222, WO 2001-FR519 20010222; US 2003009943 A1 WO
 2001-FR519 20010222, US 2002-204463 20020821; CN 1406207 A CN
 2001-805576
 20010222; JP 2003531795 W JP 2001-561679 20010222, WO 2001-FR519
 20010222

FDT AU 2001035744 A Based on WO 2001062662; EP 1259458 A1 Based on WO
 2001062662; JP 2003531795 W Based on WO 2001062662

PRAI FR 2000-2309 20000224

IC ICM C01B003-36; C01B003-38
 ICS B01D053-04; B01D053-047; B01D053-22; B01D061-58; C01B003-50;
 C01B003-56; C10K003-00

AB WO 200162662 A UPAB: 20011012
 NOVELTY - A process for the production of a gas mixture comprising
H2 and **CO** from at least one hydrocarbon comprising
methane and/or **ethane** or **butane** and
propane comprises catalytic partial oxidation of the hydrocarbon
 at no greater than 1200 deg. C and 3-20 bar in the presence of
oxygen or an **oxygen** containing gas.
 DETAILED DESCRIPTION - A process for the production of a gas
 mixture
 comprising **H2** and **CO** from at least one hydrocarbon
 comprising **methane** and/or **ethane** or **butane**
 and **propane** comprises (A) catalytic partial oxidation of the
 hydrocarbon at no greater than 1200 deg. C and 3-20 bar in the
 presence of
oxygen or an **oxygen** containing gas to produce **H2**
 and **CO**. (B) recovering a gaseous mixture containing at least
H2 and **CO** (C) subjecting the gaseous mixture from (B) to
 a temperature of neg. 20- pos. 80 deg. C. (D) subjecting the gaseous
 mixtures from (C) to a separation process to produce a gaseous stream
 rich
 in **hydrogen**. whereby a gaseous mixture is obtained from step (B)
 and/or (C) at 3-20 bar.
 USE - The process is useful for the production of **hydrogen**,
 useful for ammonia and **methanol** production, by the partial
 oxidation of hydrocarbons.

ADVANTAGE - The process was a low cost feedstock, has a high conversion to **hydrogen** and is safe to operate.

DESCRIPTION OF DRAWING(S) - The drawing shows a block scheme for the process (contains non-English text)
 catalytic partial oxidation reactor 1
 soot removal 2
 pressure swing adsorption, temperature swing adsorption or membrane separation 3
 pure **hydrogen** 4
 residual gas (27% CO, 15 % H₂) 5
 gaseous feed 6
 Dwg.1/4

FS CPI

FA AB; GI; DCN

MC CPI: E11-Q01; E31-A01; E31-H03; H04-C02; N02-C01; N02-E02; N02-F02

L60 ANSWER 30 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN

AN 2001-606717 [69] WPIX

CR 1998-271099 [24]

DNC C2001-180302

TI Catalytic conversion of **methane** or **natural gas** to syngas or **carbon monoxide** and **hydrogen** mixture involves admixing preheated **water** or steam and feed stock mixture and passing admixture feed over supported catalyst.

DC E17 E36 H04

IN CHOUDHARY, V R; MAMMAN, A S; RAJPUT, A M; UPHADE, B S

PA (COUL) COUNCIL SCI & IND RES

CYC 1

PI US 6293979 B1 20010925 (200169)* 11 C01B003-26

ADT US 6293979 B1 CIP of US 1994-359035 19941219, Cont of US 1995-372650 19950113, CIP of US 1995-517213 19950821, US 1998-20115 19980206

FDT US 6293979 B1 CIP of US 5744419

PRAI US 1998-20115 19980206; US 1994-359035 19941219;

US 1995-372650 19950113; US 1995-517213 19950821

IC ICM C01B003-26

AB US 6293979 B UPAB: 20011126

NOVELTY - A feed stock mixture is formed by mixing **oxygen** with carbon dioxide and with **methane** or **natural gas** at ambient temperature. **Water** or steam and the feed stock mixture are preheated to 600-900 deg. C. The preheated **water** or steam and the preheated feed stock mixture are admixed to form an admixture feed. The resulting admixture feed is continuously passed over a supported catalyst in a fixed bed reactor.

DETAILED DESCRIPTION - A feed stock mixture is formed by mixing **oxygen** with carbon dioxide and with **methane** or

natural gas at ambient temperature. **Water** or steam and the feed stock mixture are preheated to 600-900 deg. C. The preheated **water** or steam with the preheated feed stock mixture is admixed to form an admixture feed. The resulting add mixture feed is continuously passed over a supported catalyst in a fixed bed reactor operated (non)adiabatically, and maintaining mole ratio of organic carbon to **oxygen** and steam in the add mixture feed to 1.8-2.8 and 1.1-25, respectively. The feed stock mixture has mole ratio of CH₄/CO₂ of 3-24.8. The preheated **water** or steam is a main reactant. The catalytic conversion of **methane** or **natural gas** to syngas or a mixture of **carbon monoxide** (CO) and **hydrogen** (H₂) is performed using a supported catalyst comprising a layer of alkaline earth metal oxide on an inert refractory solid support. The catalyst contains oxides of **nickel** and **cobalt**, with or without noble metals represented by: AaCobNiOc(X)MOb(4)/S.

A is noble metal element chosen from **ruthenium** (Ru), rhodium (Rh), **palladium**, **platinum**, **iridium** and/or osmium, Co is **cobalt**, Ni is **nickel**, O is **oxygen**, M is alkaline earth metal chosen from beryllium and/or magnesium, a is A/Ni mole ratio of 0-0.1, b is Co/Ni mole ratio of 0.01-2, c is number of **oxygen** atoms required to satisfy the valence requirements of AaCobNi, d is number of **oxygen** atoms required to satisfy the valence requirements of M, S is the support for the catalyst chosen from sintered porous refractory inert solid, consisting of alumina, silica, silica-alumina, silicon carbide, zirconia and/or hafnia. The support has a surface area of 0.002-5.0 m²g⁻¹, y is 0.3-30 weight% (weight%) loading of MOd precoated on the support, and x is 0.3-30 weight% loading of AaCobNiOc deposited on the precoated support. A gas hourly space velocity of the admixture feed is 2000-200000 cm³g⁻¹h⁻¹, reaction temperature is 650-925 deg. C and pressure is 1-50 atm, so as to produce an effluent containing **carbon monoxide** and **hydrogen**. The effluent has a mole ratio of **hydrogen carbon monoxide** of 1.5-3.0, and containing less than 4 mole% of **methane** or **natural gas**. The catalytic conversion of **methane** or **natural gas** has 100% for both CO and H₂. Coupling of exothermic oxidative conversion of **methane** by O₂ and **endothermic** reforming of **methane** by steam and carbon dioxide is performed in a fixed bed reactor. The coupling is due to

simultaneous occurrence of exothermic and **endothermic** reactions, with a net heat of reactions in the overall process, H_r is -10 to +15 kcal per mole of organic carbon converted.

USE - For catalytic conversion of **methane** or **natural gas** to syngas or a mixture of **carbon monoxide** and **hydrogen**.

ADVANTAGE - The feed to the process is comprised of not only **oxygen**, steam and **methane** or **natural gas**, but also of carbon dioxide, and hence **methane** or **natural gas** is converted by its simultaneous reaction with **oxygen**, steam and carbon dioxide, yielding syngas with **hydrogen** to **carbon monoxide** mole ratio of not only above 2.0 but also below 2.0 depending upon the relative concentration of steam and carbon dioxide in the feed. Hazard due to formation of an explosive mixture during the mixing of **oxygen** with **methane** or **natural gas** containing feed is prevented by mixing **oxygen** with carbon dioxide and **methane** or **natural gas** at ambient temperature which is much below the ignition temperature of **methane** or **natural gas**. The process is operated in a very safe manner with no possibility of run-away conditions. The improved supported catalyst, having **nickel** and **cobalt** together produces synergetic effect, thereby increasing resistance to coke deposition on the catalyst and also enhancing its catalytic activity and selectivity in the oxidative **methane** or light hydrocarbons-to-syngas conversion. The addition of **cobalt** to the catalyst also reduces the reaction start temperature for the catalyst in its unreduced form. The reaction start temperature of the improved supported catalyst in its unreduced form is further decreased by the presence of noble metal in the catalyst at low concentrations. Since the sintered low surface area porous inert support comprising of a refractory material is used, the improved supported catalyst is thermally very stable, and has high mechanical strength and attrition resistance. The overall conversion process is mildly exothermic, **thermo-neutral** or mildly **endothermic**, so that the process is operated in a simple adiabatic fixed bed reactor or in a non-adiabatic fixed bed reactor without any difficulty for removing reaction heat from the reactor. The conversion of **methane** or **natural gas** to syngas over the improved supported

catalyst is performed continuously for a long period of time without catalyst deactivation due to coking, poisoning or formation of catalytically inactive binary metal oxide phases and without lowering the

mechanical strength of the catalyst or without disintegrating the catalyst into powder during the operation. Since the effluent product gases does

not contain entrained fine catalyst particles, the catalytic side reactions which cause a reduction in the selectivity for **carbon monoxide**, during the cooling of the product gas stream are eliminated.

Dwg.0/0

FS CPI

FA AB; DCN

MC CPI: E31-A01; H04-E04; H04-F02E; N01-B; N02-B01; N02-C01; N02-E; N06-F

L60 ANSWER 31 OF 54 COMPENDEX COPYRIGHT 2004 EEI on STN

AN 2001(22):6406 COMPENDEX

TI Selective production of **hydrogen** for fuel cells via oxidative steam reforming of **methanol** over CuZnAl(Zr)-oxide catalysts.

AU Velu, S. (Ceramics Technology Department Natl. Indust. Res. Inst. of Nagoya, Nagoya 462-8510, Japan); Suzuki, K.; Kapoor, M.P.; Ohashi, F.; Osaki, T.

SO Applied Catalysis A: General v 213 n 1 May 14 2001 2001.p 47-63
CODEN: ACAGE4 ISSN: 0926-860X

PY 2001

DT Journal

TC Experimental

LA English

AB Fuel cell powered vehicles using **hydrogen** (H₂) as a fuel are currently being developed in an effort to mitigate the emissions

of green house gases such as **CO₂**, NO_x, and hydrocarbons. The H₂ fuel is extracted from **methanol** onboard a vehicle by steam reforming of **methanol** (SRM) reaction. A considerable amount of **CO** is produced as a by-product, which is a poison to the Pt anode of the fuel cell. Very recently, we have demonstrated that a combined

SRM

and partial oxidation of **methanol** (POM), which we labeled as "oxidative steam reforming of **methanol** (OSRM)" reaction is more efficient for the selective production of **H₂** relatively at a lower temperature of around 230deg C over CuZnAl(Zr)-oxide catalysts derived from hydroxycarbonate precursors containing hydrotalcite

(HT)-like

layered double hydroxides (LDHs)/aurichalcite phases. There are several

operating parameters such as catalyst composition, reaction temperature,

O₂/CH₃OH and **H₂O/CH₃OH** molar ratios and **methanol** injection rate that are need to be optimized in order to produce **H₂** suitable for fuelling a fuel cell. In the present study, we have investigated the effect of these variable parameters on the catalytic performance over a series of CuZnAl- and CuZnAlZr-oxide catalysts. Our study indicated that among the CuZn-based catalysts, those containing

Zr were the most active. The optimum **O₂/CH₃OH** and **H₂O/CH₃OH** molar ratios should be in the ranges 0.20-0.30 and 1.3-1.6, respectively, in order to achieve a better catalytic performance.

Studies of the effect of **methanol** contact time on the catalytic performance over a Zr-containing catalyst revealed that the OSRM reaction

proceeds through the formation of formaldehyde intermediate. **CO** was produced as a secondary product by the decomposition of formaldehyde and it is subsequently transformed into **CO₂** and **H₂** by the **water**-gas shift (WGS) reaction. \$CPY 2001 Elsevier Science B.V. 40 Refs.

CC 804 Chemical Products Generally; 702.2 Fuel Cells; 802.2 Chemical Reactions; 641.1 Thermodynamics; 804.1 Organic Components; 803 Chemical

Agents

CT ***Hydrogen**; Carbon dioxide; **Platinum**; Anodes; **Ethanol**; **Copper** compounds; Catalysis; Fuel cells; Oxidation; Steam; Reforming reactions; **Methanol**; Catalyst selectivity

ST Steam reforming; **Water** gas shift (WGS) reactions; **Autothermal** reforming; Partial oxidation

ET H; C*O; CO; C cp; cp; O cp; Pt; Al*Cu*Zn*Zr; Al sy 4; sy 4; Cu sy 4; Zn sy

4; Zr sy 4; CuZnAl(Zr); Cu cp; Zn cp; Al cp; Zr cp; H*T; HT; H cp; T cp;

C*H*O; O₂/CH₃OH; H*O; H₂O; OH; Al*Cu*Zn; Al sy 3; sy 3; Cu sy 3; Zn sy 3;

CuZnAl; CuZnAlZr; Cu*Zn; Cu sy 2; sy 2; Zn sy 2; CuZn; Zr

L60 ANSWER 32 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 132:208276 HCA

ED Entered STN: 07 Apr 2000

TI Process for the preparation of mono-olefins from paraffinic hydrocarbons

along with the formation of fuel-grade hydrocarbons

IN Griffiths, David Charles; Maunders, Barry Martin; Woodfin, William Terence

PA BP Chemicals LTD., UK

SO PCT Int. Appl., 21 pp.
 CODEN: PIXXD2
 DT Patent
 LA English
 IC ICM C07C001-04
 ICS C10G002-00; C07C011-04; C07C029-151
 CC 35-2 (Chemistry of Synthetic High Polymers)
 Section cross-reference(s): 23, 48, 51

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2000015587	A1	20000323	WO 1999-GB2955	19990907
CU,	W: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR,				
IN,	CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID,				
MG,	IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD,				
SL,	MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,				
KG,	TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY,				
	KZ, MD, RU, TJ, TM				
DK,	RW: GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW, AT, BE, CH, CY, DE,				
CG,	ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF,				
	CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG				
	AU 9956421	A1	20000403	AU 1999-56421	19990907
	AU 751027	B2	20020808		
	BR 9913555	A	20010605	BR 1999-13555	19990907
	EP 1129056	A1	20010905	EP 1999-943151	19990907
PT,	R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC,				
	IE, SI, LT, LV, FI, RO				
	US 6395944	B1	20020528	US 2000-632633	20000804
	US 2002143220	A1	20021003	US 2002-93725	20020311
	US 6555721	B2	20030429		
PRAI	GB 1998-19645	A	19980910		
	WO 1999-GB2955	W	19990907		
	US 2000-632633	A1	20000804		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 2000015587	ICM	C07C001-04
	ICS	C10G002-00; C07C011-04; C07C029-151
US 6395944	ECLA	C07C001/04H; C07C005/48; C07C029/151B1;
C10G002/00B;		

C10G009/38; C10G011/22

US 2002143220 ECLA C07C001/04H; C07C005/48; C07C029/151B1;
C10G002/00B;

C10G009/38; C10G011/22

AB A process for the production of a mono-olefin from a paraffinic hydrocarbon

comprises: (A) feeding the paraffin and a mol. **oxygen**-containing gas to an **autothermal** cracker where they are reacted by oxidative dehydrogenation to form a product comprising ≥ 1 mono-olefin(s) and synthesis gas; (B) separating the product from step A into a synthesis gas-containing stream and ≥ 1 olefins and recovering the olefin(s);

and

(C) contacting the synthesis gas-containing stream separated in step B with either

(i) a catalyst for the conversion of synthesis gas into **methanol** or (ii) a catalyst for the **water** gas shift reaction where the **carbon monoxide** in the synthesis gas is converted with **water** into **hydrogen** and **carbon dioxide**

and then recovering the **hydrogen**, or (iii) a catalyst for the conversion of synthesis gas to hydrocarbons, and the hydrocarbon product.

Process flow diagrams are presented.

ST olefin manuf alkane oxidative dehydrogenation; ethene manuf; **ethylene** manuf; alkene manuf; **water** gas shift reaction manuf alkene; synthesis gas manuf

IT Dehydrogenation

(oxidative; process for the preparation of mono-olefins from paraffinic hydrocarbons via)

IT Alkanes, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(process for the preparation of mono-olefins from)

IT Alkenes, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)

(process for the preparation of mono-olefins from paraffinic hydrocarbons)

IT **Water** gas shift reaction

(process for the preparation of mono-olefins from paraffinic hydrocarbons using)

IT Cracking (reaction)

(process for the preparation of mono-olefins from paraffinic hydrocarbons via)

IT **Diesel** fuel

Synthesis gas

(process for the preparation of mono-olefins from paraffinic hydrocarbons)

with the formation of)

IT Naphtha
RL: IMF (Industrial manufacture); PREP (Preparation)
(process for the preparation of mono-olefins from paraffinic hydrocarbons with the formation of)

IT 124-38-9P, Carbon dioxide, preparation
RL: BYP (Byproduct); PREP (Preparation)
(process for the preparation of mono-olefins from paraffinic hydrocarbons)

IT 74-85-1P, Ethene, preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(process for the preparation of mono-olefins from paraffinic hydrocarbons)

IT 67-56-1P, Methanol, preparation 630-08-0P, Carbon monoxide, preparation 1333-74-0P, Hydrogen, preparation
RL: IMF (Industrial manufacture); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)
(process for the preparation of mono-olefins from paraffinic hydrocarbons)

IT 7782-44-7, Oxygen, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(process for the preparation of mono-olefins from paraffinic hydrocarbons)

IT 1332-37-2, Iron oxide, uses
RL: CAT (Catalyst use); USES (Uses)
(water gas shift reaction catalyst; process for the preparation of mono-olefins from paraffinic hydrocarbons)

RE.CNT 4 THERE ARE 4 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

(1) British Petroleum Co Plc; EP 0199475 A 1986 HCA
(2) Metallgesellschaft Ag; DE 19507098 A 1996, P3 HCA
(3) Monsanto Chemical Co; GB 794157 A HCA
(4) Read, A; US 4264435 A 1981 HCA

L60 ANSWER 33 OF 54 COMPENDEX COPYRIGHT 2004 EEI on STN

AN 2001(4):7238 COMPENDEX

TI Influence of cycle parameters on periodically operated fluidized bed reactor for CH4 autoreforming.

AU Opoku-Gyamfi, Kingsley (Univ of New South Wales, Sydney, Australia); Vieira-Dias, Joaquim; Adesina, Adesoji A.

SO Catalysis Today v 63 n 2-4 Dec 2000. p 507-515, Elsevier Science Publishers B.V., Amsterdam, Netherlands
CODEN: CATTEA ISSN: 0920-5861

PY 2000

DT Journal

TC Experimental

LA English

AB **Autothermal** reforming of CH₄ has been studied under both periodic and steady state conditions. The investigation was conducted over

Co-NiO in a fluidized bed reactor at 873 K and 101.32 kPa. Cycle periods of 1-40 min were used whilst the cycle split, Sox (with respect to

the **O₂**-rich cycle) was varied from 0.1 to 0.9. Generally, CH₄ oxidation stimulated **CO** formation, however, steam reforming yielded predominantly **CO₂** and **H₂**. Although **O₂**-rich cycling (Sox ≥ 0.5) was detrimental to **H₂** formation, **H₂O**-rich cycling resulted in a 15% improvement in steady state **H₂** formation. Theoretical as well as experimental investigations pointed to a resonant frequency of about 6.7 mHz for CH₄ oxidation to produce super steady state **H₂** yields. By periodic operation, it is possible to tune **H₂/CO** ratios over the range 2.5-7 for the same feed composition. Interestingly, Sox = 0.1 yielded the highest ratios, whereas the lowest ratios were attained at Sox = 0.9. Periodic composition cycling introduces a more flexible approach to reactor operation - **H₂/CO** can be easily modulated by varying the cycle parameters - compared to steady state

operation. (Author

abstract) 17 Refs.

CC 803 Chemical Agents; 804 Chemical Products Generally; 804.1 Organic Components; 804.2 Inorganic Components; 533.1 Ore Treatment; 549.3

Others

(including Bismuth, Boron, Cadmium, Cobalt, Mercury, Niobium, Selenium, Silicon, Tellurium and Zirconium)

CT *Catalysts; Fluidized bed process; **Cobalt**; Nitrogen oxides; Oxidation; Natural frequencies; Composition effects; **Methanol**; Ammonia

ST Fluidized bed reactors; Autoreforming

ET Co*Ni*O; Co sy 3; sy 3; Ni sy 3; O sy 3; NiO; Ni cp; cp; O cp; Co-NiO; O;

C*O; CO; C cp; H; H*O; H₂O; H cp; C*H*O; H₂/CO

L60 ANSWER 34 OF 54 HCA COPYRIGHT 2004 ACS on STN DUPLICATE 3

AN 133:122031 HCA

ED Entered STN: 18 Aug 2000

TI Mathematical simulations of reactors for catalytic conversion of **methane** to syngas with forced concentration cycling

AU Gosiewski, Krzysztof

CS Pedagogical University of Czestochowa - Institute of Chemistry, Czestochowa, 42-201, Pol.

SO Chemical Engineering and Processing (2000), 39(5), 459-469
CODEN: CENPEU; ISSN: 0255-2701

PB Elsevier Science S.A.

DT Journal
LA English
CC 47-3 (Apparatus and Plant Equipment)
Section cross-reference(s): 49, 51
AB In this paper simulation results are presented concerning the partial catalytic oxidation of **methane** (PCOM) in a reactor with forced composition cycling and packed with a pelletized Pt/MgO catalyst.
The reactor operates in two cycles, namely, the "hot" cycle, H, during which mainly the reactants of the strongly **exothermal** complete combustion reaction (CH₄ and O₂) are supplied, and the "cold" cycle, C, in which mainly the components of the **endothermal** reforming reactions are introduced (CH₄ and H₂O or, optionally CO₂). The simulations are supplemented with a thermodyn. anal. of the conditions of permanent carbon deposits forming in such a reactor.
The simulation results are compared with those obtained for a reactor operating at a constant (averaged) composition of the reacting mixture. The simulation led to the conclusion that, in a reactor with periodic cycling in the inlet composition, high reactant conversions (conversion of CH₄ close to 100%) and product selectivities as high as 90% (relative to H₂ and CO) can be achieved.
ST reactor **methane** catalytic conversion syngas simulation; forced concn cycling **methane** syngas catalytic conversion; partial catalytic oxidn **methane** syngas conversion simulation; platinum magnesium oxide oxidn catalyst **methane** conversion syngas
IT Oxidation
(catalytic; simulation of partial catalytic oxidation of **methane** in reactor with forced composition cycling and packed with pelletized platinum/magnesium oxide catalyst)
IT Reactors
Simulation and Modeling, physicochemical
(math. simulation of reactors for catalytic conversion of **methane** to syngas with forced concentration cycling)
IT Synthesis gas manufacturing
(partial oxidation; simulation of partial catalytic oxidation of **methane** in reactor with forced composition cycling and packed with pelletized platinum/magnesium oxide catalyst)
IT 74-82-8, **Methane**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(math. simulation of reactors for catalytic conversion of **methane** to syngas with forced concentration cycling)
IT 1309-48-4, Magnesium oxide, uses 7440-06-4, Platinum, uses

RL: **CAT (Catalyst use)**; USES (Uses)

(simulation of partial catalytic oxidation of **methane** in reactor with forced composition cycling and packed with pelletized platinum/magnesium oxide catalyst)

RE.CNT 4 THERE ARE 4 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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- (2) Anon; Polish Patent Application No P 331126 1999
- (3) Szarawara, J; Chem Stosow 1986, V30, P395 HCA
- (4) Xu, J; AIChE J 1989, V35, P97 HCA

L60 ANSWER 35 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 132:253367 HCA

ED Entered STN: 28 Apr 2000

TI Energy efficient conversion of **methane** to syngas over NiO-MgO solid solution

AU Choudhary, V. R.; Mamman, A. S.

CS Chemical Engineering Division, National Chemical Laboratory, Pune, India

SO Applied Energy (2000), 66(2), 161-175
CODEN: APENDX; ISSN: 0306-2619

PB Elsevier Science Ltd.

DT Journal

LA English

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)
Section cross-reference(s): 67

AB **Methane** to **CO** and **H2** conversion reactions, involving partial oxidation by **O2**, oxy-steam reforming, oxy-**CO2** reforming, **CO2** reforming, simultaneous steam and **CO2** reforming, over a NiO-MgO solid solution (Ni/Mg =0.5) have been investigated. The calcination (up to 1200°C) temperature of the catalyst

has a small **but** significant effect on its activity/selectivity in the oxidative conversion of **methane** to syngas. The reduction (by **H2**) temperature of the catalyst has no significant effect on the catalyst's performance. The catalyst shows high activity and selectivity

in the oxy-steam reforming and oxy-**CO2** reforming reactions, at 800-850°C and high space velocity [(40-50)+103 cm³ g⁻¹ h⁻¹]. These two processes involve coupling of the **exothermic** oxidative conversion and **endothermic** steam or **CO2** reforming reactions, making both the processes highly energy efficient and also safe

to operate. The catalyst also shows high **methane** conversion activity (nearly 95% conversion) with 100% selectivity for both **CO** and **H2** in the simultaneous steam and **CO2** reforming of **methane** at (800-850°C) at a high space velocity (3.6+103 cm³ g⁻¹ h⁻¹).

ST **methane** reforming synthesis gas prodn NiO MgO; nickel oxide
magnesium oxide reforming catalyst

IT Reforming catalysts
Steam reforming catalysts
(energy efficient conversion of **methane** to syngas over
NiO-MgO solid solution)

IT **Natural gas**, uses
RL: NUU (Other use, unclassified); PEP (Physical, engineering or
chemical
process); TEM (Technical or engineered material use); PROC (Process);
USES
(Uses)
(energy efficient conversion of **methane** to syngas over
NiO-MgO solid solution)

IT Synthesis gas manufacturing
(partial oxidation, steam reforming; energy efficient conversion of
methane to syngas over NiO-MgO solid solution)

IT Synthesis gas manufacturing
(partial oxidation; energy efficient conversion of **methane** to
syngas over NiO-MgO solid solution)

IT Oxidation catalysts
(partial; energy efficient conversion of **methane** to syngas
over NiO-MgO solid solution).

IT Synthesis gas manufacturing
(reforming synthesis gas manufacturing, oxy-CO₂ reforming;
CO₂ reforming; energy efficient conversion of **methane**
to syngas over NiO-MgO solid solution)

IT Synthesis gas manufacturing
(steam reforming synthesis gas manufacturing, oxy-steam reforming;
CO₂-steam reforming; energy efficient conversion of
methane to syngas over NiO-MgO solid solution)

IT 1309-48-4, Magnesium oxide, uses 1313-99-1, Nickel oxide (NiO), uses
144228-60-4, Magnesium nickel oxide
RL: CAT (Catalyst use); USES (Uses)
(energy efficient conversion of **methane** to syngas over
NiO-MgO solid solution)

IT 630-08-0P, Carbon monoxide, preparation
1333-74-0P, Hydrogen, preparation
RL: IMF (Industrial manufacture); PEP (Physical, engineering or
chemical process); PREP (Preparation); PROC (Process)
(energy efficient conversion of **methane** to syngas over
NiO-MgO solid solution)

IT 74-82-8, Methane, reactions 7782-44-7,
Oxygen, reactions
RL: PEP (Physical, engineering or chemical process); RCT (Reactant);
PROC
(Process); RACT (Reactant or reagent)
(energy efficient conversion of **methane** to syngas over

NiO-MgO solid solution)

IT 7732-18-5, Water, reactions

RL: PEP (Physical, engineering or chemical process); RCT (Reactant);

PROC

(Process); RACT (Reactant or reagent)

(vapor; energy efficient conversion of methane to syngas over
NiO-MgO solid solution)

RE.CNT 39 THERE ARE 39 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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L60 ANSWER 36 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 134:101216 HCA

ED Entered STN: 08 Feb 2001

TI Understanding Homogeneous and Heterogeneous Contributions to the
Platinum-Catalyzed Partial Oxidation of **Ethane** in a
Short-Contact-Time Reactor

AU Zerkle, David K.; Allendorf, Mark D.; Wolf, Markus; Deutschmann, Olaf

CS Chemical Science and Technology Division, Los Alamos National
Laboratory,

Los Alamos, NM, 87545, USA

SO Journal of Catalysis (2000), 196(1), 18-39

CODEN: JCTLA5; ISSN: 0021-9517

PB Academic Press

DT Journal

LA English

CC 35-2 (Chemistry of Synthetic High Polymers)

Section cross-reference(s): 45

AB This paper describes a computational study of the partial oxidation of
ethane to **ethylene** in a short-contact-time reactor,
using a two-dimensional computational fluid dynamics model with full
heat

and mass transport. Detailed heterogeneous and homogeneous chemical
kinetic

mechanisms are employed to describe the chemical Rate consts. for
elementary

surface reactions are determined from literature sources or by
fitting model

predictions to exptl. data. Simulations using these mechanisms
suggest

that platinum-catalyzed heterogeneous chemical processes are
responsible for

the oxidation of surface carbon and **hydrogen**, resulting in
localized heat release into the gas phase. This heat release drives
endothermic homogeneous and heterogeneous cracking of
ethane to **ethylene** and **H2**. The

proportion of homogeneous and heterogeneous contributions depends
strongly upon the reactor operating conditions. In addition to
predictions

of **ethane** conversion and **ethylene** selectivity, the

model also predicts the production of all other major products: **H2O**, **H2**, **CH4**, **CO**, and **CO2**. A good fit is obtained between model predictions and exptl. data for **ethane/oxygen** mixts. The model is applied to **ethane/hydrogen/oxygen** mixts. and good agreement with this set of exptl. data is also obtained. (c) 2000 Academic Press.

ST **ethane** partial oxidn kinetics simulation; mechanism

ethane oxidative dehydrogenation **ethylene**

IT Oxidation

Oxidation kinetics

Simulation and Modeling, physicochemical

(heterogeneous and homogeneous chemical kinetic mechanisms in partial

oxidation of **ethane** to **ethylene**)

IT Dehydrogenation

(oxidative; heterogeneous and homogeneous chemical kinetic mechanisms in

partial oxidation of **ethane** to **ethylene**)

IT **7440-06-4**, Platinum, uses

RL: **CAT (Catalyst use)**; USES (Uses)

(heterogeneous and homogeneous chemical kinetic mechanisms in partial

oxidation of **ethane** to **ethylene**)

IT **74-85-1P, Ethylene**, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)

(heterogeneous and homogeneous chemical kinetic mechanisms in partial

oxidation of **ethane** to **ethylene**)

IT **74-84-0, Ethane**, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(heterogeneous and homogeneous chemical kinetic mechanisms in partial

oxidation of **ethane** to **ethylene**)

RE.CNT 78 THERE ARE 78 CITED REFERENCES AVAILABLE FOR THIS RECORD
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HCA

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L60 ANSWER 37 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 130:198681 HCA

ED Entered STN: 03 Apr 1999

TI Process for improved heat integration of an oxidant-supplemented **autothermal** reformer and cogeneration power plant

IN Marler, David Owen; Kennedy, Robert Clinton

PA Mobil Oil Corporation, USA

SO PCT Int. Appl., 39 pp.

CODEN: PIXXD2

DT Patent

LA English

IC ICM C07C001-02

CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 9911591	A1	19990311	WO 1998-US17177	19980820
	W: CN, JP, KR				
	RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,				
NL,	PT, SE				
	EP 1017653	A1	20000712	EP 1998-942124	19980820
	R: DE, FR, GB, IT, NL				
	JP 2001514155	T2	20010911	JP 2000-508635	19980820
	ZA 9807695	A	20000225	ZA 1998-7695	19980825
PRAI	US 1997-919661	A	19970828		

WO 1998-US17177 W 19980820

CLASS

PATENT NO. CLASS PATENT FAMILY CLASSIFICATION CODES

WO 9911591 ICM C07C001-02

AB A process is described for integration of an **autothermal** reforming unit and a cogeneration power plant in which the reforming unit has two communicating fluidized beds. The first fluidized bed is a reformer reactor containing inorg. metal oxide particles supplied with supplemental oxidant gas (**O2**, enriched air, air) for oxidation of light hydrocarbons primarily by oxidant supplied from the inorg. metal oxide and oxidant gas at conditions sufficient to produce a mixture of synthesis gas, **hydrogen**, **carbon monoxide**, and **carbon dioxide**. The second fluidized bed is a combustor-regenerator which receives reduced inorg. metal oxide particles from the first fluidized bed and provides heat to the inorg. metal oxide by combusting fuel gas in direct contact with the particles producing hot flue gas. Steam is also fed to the reformer and a catalyst may be used with the inorg. metal oxide and oxidant gas. The cogeneration power plant has a gas turbine equipped with an air compressor and a combustor and is integrated thermally by a portion of compressed air which is drawn off from the power plant gas turbine air compressor and introduced to the combustor-regenerator, while the hot flue gas from the combustor-regenerator is mixed with the remainder of the compressed air to produce a recombined gas stream which is fed to the combustor of the cogeneration gas turbine power plant.

ST hydrocarbon reformer cogeneration power plant heat integration; synthesis gas reformer power plant heat integration; **natural gas** reformer power plant heat integration

IT Reforming apparatus
(**autothermal**, fluidized-bed; heat integration of oxidant supplemented **autothermal** hydrocarbon reformer and cogeneration power plant)

IT Energy conservation
(heat integration of oxidant supplemented **autothermal** hydrocarbon reformer and cogeneration power plant)

IT Oxides (inorganic), processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(heat integration of oxidant supplemented **autothermal**

hydrocarbon reformer and cogeneration power plant)

IT Hydrocarbons, reactions
Natural gas, reactions
RL: PEP (Physical, engineering or chemical process); RCT (Reactant);
PROC (Process); RACT (Reactant or reagent)
(heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

IT Power
(plants, cogeneration; heat integration of oxidant supplemented
autothermal hydrocarbon reformer and cogeneration power plant)

IT Steam
(production; heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

IT Synthesis gas manufacturing
Synthesis gas manufacturing
(reforming synthesis gas manufacturing; heat integration of oxidant
supplemented **autothermal** hydrocarbon reformer and
cogeneration power plant)

IT Reforming apparatus
(steam, **autothermal**, fluidized-bed; heat integration of
oxidant supplemented **autothermal** hydrocarbon reformer and
cogeneration power plant)

IT 7440-02-0, Nickel, uses
RL: CAT (Catalyst use); USES (Uses)
(heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

IT 124-38-9P, Carbon dioxide, preparation
630-08-0P, Carbon monoxide, preparation
1333-74-0P, Hydrogen, preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

IT 1344-70-3, Copper oxide
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

IT 74-82-8, Methane, reactions 7782-44-7,
Oxygen, reactions
RL: PEP (Physical, engineering or chemical process); RCT (Reactant);
PROC (Process); RACT (Reactant or reagent)
(heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

IT 1344-28-1, Alumina, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(support; heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

IT 7732-18-5P, Water, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)
(vapor; heat integration of oxidant supplemented **autothermal**
hydrocarbon reformer and cogeneration power plant)

RE.CNT 5 THERE ARE 5 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

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L60 ANSWER 38 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 131:104091 HCA

ED Entered STN: 14 Aug 1999

TI Forced composition cycling of a novel thermally self-sustaining
fluidized-bed reactor for methane reforming

AU Opoku-Gyamfi, Kingsley; Adesina, Adesoji A.

CS Reactor Engineering and Technology Group, School of Chemical
Engineering

and Industrial Chemistry, University of New South Wales, Sydney, 2052,
Australia

SO Chemical Engineering Science (1999), 54(13-14), 2575-2583
CODEN: CESCAC; ISSN: 0009-2509

PB Elsevier Science Ltd.

DT Journal

LA English

CC 49-10 (Industrial Inorganic Chemicals)
Section cross-reference(s): 51

AB The novel coupling of methane oxidation and steam reforming via
periodic

composition forcing can be used to operate a thermally self-sustaining
fluidized-bed reactor (FBR). The **autothermal** reaction was
carried out over an alumina-supported Co-NiO catalyst. The
catalyst exhibited synergism for the steam reforming reaction although
extent of synergy decreased from 3.2 at 773 K to 1.4 at 873 K. Anal.

of

steady-state oxidation and steam reforming rates showed that the
bifunctional

catalyst would favor H₂ production in a well-mixed reactor at the
lowest temperature

permissible (773 K). Cycle symmetry, SOX, has to be greater than 0.3

to

achieve thermal self-sustainability. However, time-average rate and
H₂ yield

increased with cycle frequency. Interestingly, even at the
relatively low

H₂O:CH₄ molar ratio of 1, coking was practically non-existent

probably due to carbon gasification via reaction with **O2** and **H2O** in the periodically-operated FBR. This investigation shows that the coupling of energetics, kinetics and reactor operation may lead to serendipity in reactor performance.

ST fluidized bed reactor methane reforming
 IT Reactors
 Reactors
 (fluidized-bed; forced composition cycling of novel thermally self-sustaining fluidized-bed reactor for methane reforming)

IT Oxidation
 Steam reforming
 Steam reforming catalysts
 Synthesis gas manufacturing
 (forced composition cycling of novel thermally self-sustaining fluidized-bed reactor for methane reforming)

IT Fluidized beds
 Fluidized beds
 (reactors; forced composition cycling of novel thermally self-sustaining fluidized-bed reactor for methane reforming)

IT 1313-99-1, Nickel oxide (NiO), uses 1344-28-1, Aluminum oxide (Al2O3),
 uses 7440-48-4, Cobalt, uses
 RL: **CAT (Catalyst use); USES (Uses)**
 (forced composition cycling of novel thermally self-sustaining fluidized-bed reactor for methane reforming)

IT 630-08-0P, **Carbon monoxide**, preparation
 1333-74-0P, Hydrogen, preparation
 RL: **IMF (Industrial manufacture); PREP (Preparation)**
 (forced composition cycling of novel thermally self-sustaining fluidized-bed reactor for methane reforming)

IT 74-82-8, Methane, reactions
 RL: **RCT (Reactant); RACT (Reactant or reagent)**
 (forced composition cycling of novel thermally self-sustaining fluidized-bed reactor for methane reforming)

RE.CNT 12 THERE ARE 12 CITED REFERENCES AVAILABLE FOR THIS RECORD
 RE

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L60 ANSWER 39 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 128:130274 HCA

ED Entered STN: 10 Mar 1998

TI Process for catalytic conversion of **water** and **carbon dioxide** to low cost energy, **hydrogen**, **carbon monoxide**, **oxygen** and hydrocarbons

IN Swanson, Rollin C.

PA USA

SO U.S., 7 pp., Cont.-in-part of U.S. 5,516,742.

CODEN: USXXAM

DT Patent

LA English

IC ICM B01J023-02

ICS C10G001-00; C01B031-18; C01B013-02

NCL 502340000

CC 52-1 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 49, **51**, 67

FAN.CNT 2

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	US 5710087	A	19980120	US 1995-476199	19950607
	US 5516742	A	19960514	US 1994-313433	19940927
	WO 9609888	A1	19960404	WO 1995-US13115	19950927
	W: AU, BR, CA, JP, RU				
	RW: AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				
	AU 9538313	A1	19960419	AU 1995-38313	19950927
PRAI	US 1994-313433	A2	19940927		
	US 1995-476199	A	19950607		
	WO 1995-US13115	W	19950927		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
US 5710087	ICM	B01J023-02
	ICS	C10G001-00; C01B031-18; C01B013-02
	NCL	502340000

AB The present invention is a novel process for producing low-cost energy, H,

hydrocarbons, **CO**, and O by reacting **CO2** and **water** over a catalyst complex to form low-cost energy, various weight hydrocarbons, **CO** and H which may be used as fuels or for other purposes. The low-cost energy results from the heat generated by the

- exothermic** nature of the reaction and is evidenced by the increased temperature of the reactor during the reaction. The catalyst complex is made from a hydrated magnesium carbonate/hydroxide complex and a catalyst support. The reactants are **CO2** and **water**. This reaction is intended to be used at sites where excess steam, heat or **CO2** are produced and are readily available. The recycle of these otherwise excess waste products can be economically advantageous by producing useful products and be environmentally advantageous by reducing both greenhouse gas emissions and thermal exhaust. Moreover, if desired, a fuel may be added to the process, e.g., coal, to further the production of orgs.
- ST catalytic conversion **water carbon dioxide** reaction; energy prodn **hydrogen carbon monoxide oxygen**; catalyst magnesium hydroxide carbonate complex energy; hydrocarbon manuf catalytic conversion **carbon dioxide**
- IT Coal, uses
RL: **CAT (Catalyst use)**; NUU (Other use, unclassified); RCT (Reactant); RACT (Reactant or reagent); USES (Uses)
(catalyst support; process for catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)
- IT Fuel gas manufacturing
(process for catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)
- IT Hydrocarbons, preparation
RL: PNU (Preparation, unclassified); PREP (Preparation)
(process for catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)
- IT 471-34-1, Calcium carbonate, uses 7758-11-4, Dipotassium **hydrogen** phosphate 7760-50-1, Magnesium carbonate hydroxide (Mg5(CO3)4(OH)2)
RL: **CAT (Catalyst use)**; USES (Uses)
(catalysts containing; process for catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)
- IT 74-82-8P, **Methane**, preparation 630-08-0P, **Carbon monoxide**, preparation 1333-74-0P, **Hydrogen**, preparation 7782-44-7P, **Oxygen**,

preparation

RL: PNU (Preparation, unclassified); PREP (Preparation)
(process for catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen**, **carbon monoxide**, **oxygen** and hydrocarbons)

IT 124-38-9, **Carbon dioxide**, reactions

7732-18-5, **Water**, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)
(process for catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen**, **carbon monoxide**, **oxygen** and hydrocarbons)

IT 12597-69-2, **Steel**, uses

RL: CAT (Catalyst use); NUU (Other use, unclassified); USES
(Uses)

(shavings; process for catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen**, **carbon monoxide**, **oxygen** and hydrocarbons)

RE.CNT 2 THERE ARE 2 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

(1) Squires; US 3402998 1968

(2) Swanson; US 5516742 1996 HCA

L60 ANSWER 40 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 129:345204 HCA

ED Entered STN: 19 Dec 1998

TI Syngas formation by partial oxidation of **methane** in palladium
membrane reactor

AU Kikuchi, E.; Chen, Y.

CS Department of Applied Chemistry, School of Science & Engineering,
Waseda

University, Tokyo, 169-8555, Japan

SO Studies in Surface Science and Catalysis (1998), 119(Natural Gas
Conversion V), 441-446

CODEN: SSCTDM; ISSN: 0167-2991

PB Elsevier Science B.V.

DT Journal

LA English

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)

AB The partial oxidation of **methane** (POM) occurred at a low temperature
of

500°C by reaction of an **oxygen**-deficient CH₄/O₂
mixture over supported precious metal catalysts. The catalytic
activities

decreased in the order of Rh, Pt, Pd, Ir, and Rh/Al₂O₃ also showed a
high

catalytic selectivity for the oxidative conversion of CH₄ to **CO**
and **H₂**. On application of a **hydrogen**-permeable

membrane reactor, CH₄ conversion and production of **CO** and **H₂** were promoted by removing **H₂** from the reaction system. In the membrane reactor, it was also found that deposition of coke began being exactly at the consumption of **H₂O**. Addition of steam to the reactant flow could effectively depress the coke deposition and improve the yield of **H₂** via steam reforming and **water**-gas shift reaction. The reaction path over these catalysts involved a sequence of following reactions: the initial complete oxidation of part of the **methane** to **CO₂** and **H₂O**, followed by the highly **endothermic** steam reforming and **CO₂** reforming of unconverted **methane**, and **water**-gas shift reaction, establishing an equilibrium. The equilibrium of air POM in the membrane reactor gives a product mixture of **H₂**, **CO₂**, and **N₂**. This can provide an internal heating process to produce pure **H₂** without formation of **CO**. **H₂** thus produced is separated from **CO₂** and **N₂**, followed by the reverse **water** gas shift reaction to adjust the **H₂/CO** ratio in a conventional reactor. This provides a more economical POM process as the separation of **CO₂** from **N₂** in the unpermeated gas from the membrane reactor should be less costly than air separation.

ST **methane** oxidn syngas palladium membrane reactor
IT Reactors .
(membrane; syngas formation by partial oxidation of **methane** in palladium membrane reactor)

IT Oxidation
(partial; syngas formation by partial oxidation of **methane** in palladium membrane reactor)

IT Synthesis gas
(syngas formation by partial oxidation of **methane** in palladium membrane reactor)

IT **7440-05-3**, Palladium, uses
RL: **CAT (Catalyst use)**; **USES (Uses)**
(syngas formation by partial oxidation of **methane** in palladium membrane reactor)

IT **74-82-8**, **Methane**, processes
RL: **PEP (Physical, engineering or chemical process)**; **PROC (Process)**
(syngas formation by partial oxidation of **methane** in palladium membrane reactor).

RE.CNT 16 THERE ARE 16 CITED REFERENCES AVAILABLE FOR THIS RECORD
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(2) Chang, Y; Catal Lett 1993, V21, P215 HCA
(3) Choudhary, V; J Catal 1993, V139, P326 HCA

- (4) Choudhary, V; J Phys Chem 1992, V96, P8686 HCA
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- (15) Uemiya, S; Ind Eng Chem Res 1991, V30, P589
- (16) Vernon, P; Catal Today 1992, V13, P417 HCA

L60 ANSWER 41 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 130:83634 HCA

ED Entered STN: 06 Feb 1999

TI Simultaneous oxidative conversion and **CO2** or steam reforming of **methane** to syngas over CoO-NiO-MgO catalyst

AU Choudhary, Vasant R.; Mamman, Ajit S.

CS Chemical Engineering Division, National Chemical Laboratory, Pune, 411008, India

SO Journal of Chemical Technology & Biotechnology (1998), 73(4), 345-350
CODEN: JCTBED; ISSN: 0268-2575

PB John Wiley & Sons Ltd.

DT Journal

LA English

CC 49-1 (Industrial Inorganic Chemicals)

AB **CO2** reforming, oxidative conversion and simultaneous oxidative conversion and **CO2** or steam reforming of **methane** to syngas (**CO** and **H2**) over NiO-CoO-MgO (**Co** :Ni:Mg = 0.5:0.5:1.0) solid solution at 700-850° and high space velocity (5.1 + 105 cm³ g⁻¹ h⁻¹ for oxidative conversion and 4.5 + 104 cm³ g⁻¹ h⁻¹ for oxy-steam or oxy-**CO2** reforming) for different CH₄/**O2** (1.8-8.0) and CH₄/**CO2** or **H2O** (1.5-8.4) ratios have been thoroughly investigated. Because of the replacement of 50 mol% of the NiO by CoO in NiO-MgO (Ni/Mg = 1.0), the performance of the catalyst in the **methane** to syngas conversion process is improved; the carbon formation on the catalyst is drastically

reduced. The CoO-NiO-MgO catalyst shows high **methane** conversion activity (**methane** conversion > 80%) and high selectivity for both **CO** and **H2** in the oxy-**CO2** reforming and oxy-steam reforming processes at ≥800°. The oxy-steam or **CO2** reforming process involves the coupling of the **exothermic** oxidative conversion and **endothermic** **CO2** or steam reforming reactions, making these processes highly

energy efficient and also safe to operate. These processes can be made **thermo neutral** or mildly **exothermic** or mildly **endothermic** by manipulating the process conditions (viz. temperature and/or CH₄/O₂ ratio in the feed).

ST reforming **methane** syngas steam carbon dioxide; catalyst reforming **methane** syngas

IT Oxidation

Reforming

Reforming catalysts

Steam reforming

Steam reforming catalysts

Synthesis gas manufacturing

(simultaneous oxidative conversion and **CO₂** or steam reforming of **methane** to syngas over CoO-NiO-MgO catalyst)

IT 1307-96-6, Cobalt monoxide, uses 1309-48-4, Magnesia, uses 1313-99-1,

Nickel monoxide, uses

RL: **CAT (Catalyst use)**; USES (Uses)

(simultaneous oxidative conversion and **CO₂** or steam reforming of **methane** to syngas over CoO-NiO-MgO catalyst)

IT 630-08-0P, **Carbon monoxide**, preparation

1333-74-0P, **Hydrogen**, preparation

RL: IMF (Industrial manufacture); PREP (Preparation)

(simultaneous oxidative conversion and **CO₂** or steam reforming of **methane** to syngas over CoO-NiO-MgO catalyst)

IT 74-82-8, **Methane**, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(simultaneous oxidative conversion and **CO₂** or steam reforming of **methane** to syngas over CoO-NiO-MgO catalyst)

RE.CNT 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD
RE

(1) Bhardwaj, S; Fuel Processing Technology 1995, V42, P109

(2) Choudhary, V; Angew Chem Int Ed Engl 1992, V31, P1189

(3) Choudhary, V; Appl Catal A: Gen 1992, V90, PL1 HCA

(4) Choudhary, V; Appl Catal A: Gen 1997, V162, P235 HCA

(5) Choudhary, V; J Catal 1997, V172, P281 HCA

(6) Elvers, B; Ulmann's Encyclopaedia of Industrial Chemistry 12 5th revised edn 1989, VA, P169

(7) Highfield, J; Stud Surf Sci Catal 1983, V16, P181 HCA

(8) Kirk, R; Encyclopedia of Chemical Technology 3rd edn V12, P938

(9) Stone, F; J Mol Catal 1990, V59, P147 HCA

(10) Tsang, S; Catal Today 1995, V23, P3 HCA

L60 ANSWER 42 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 125:15022 HCA

ED Entered STN: 03 Jul 1996

TI Catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen**, **carbon monoxide**, **oxygen** and hydrocarbons
 IN Swanson, Rollan
 PA USA
 SO PCT Int. Appl., 23 pp.
 CODEN: PIXXD2
 DT Patent
 LA English
 IC ICM B01J023-02
 CC 51-11 (Fossil **Fuels**, Derivatives, and Related Products)
 Section cross-reference(s): 49, 52, 67

FAN.CNT 2

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 9609888	A1	19960404	WO 1995-US13115	19950927
	W: AU, BR, CA, JP, RU				
	RW: AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE				
	US 5516742	A	19960514	US 1994-313433	19940927
	US 5710087	A	19980120	US 1995-476199	19950607
	AU 9538313	A1	19960419	AU 1995-38313	19950927
PRAI	US 1994-313433	A	19940927		
	US 1995-476199	A	19950607		
	WO 1995-US13115	W	19950927		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
WO 9609888	ICM	B01J023-02

AB The present invention is a novel process for producing low-cost energy,

hydrogen, hydrocarbons, **carbon monoxide**, and **oxygen** by reacting **carbon dioxide** and **water** over a catalyst complex to form low-cost energy, various weight hydrocarbons, **carbon monoxide** and **hydrogen** which may be used as fuels or for other purposes. The low-cost energy results from the heat generated by the **exothermic** nature of the reaction and is evidenced by the increased temperature of the reactor during the reaction. The catalyst complex is made from a hydrated magnesium carbonate/hydroxide complex and a catalyst support. The reactants are **carbon dioxide** and **water**. This reaction is intended to be used at sites where excess steam, heat or **carbon dioxide** are produced and are readily available. The recycle of these otherwise excess "waste" products can be economically advantageous

by producing useful products and be environmentally advantageous by reducing both greenhouse gas emissions and thermal exhaust. Moreover, if

the desired, a fuel may be added to the process, e.g., coal, to further
production of orgs.

ST **water carbon dioxide** catalytic conversion
fuel; energy **hydrogen carbon monoxide**
hydrocarbon prodn; magnesium carbonate hydroxide catalyst complex coal

IT Fuel gas manufacturing
(catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT Hydrocarbons, preparation
RL: PNU (Preparation, unclassified); PREP (Preparation)
(catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT Coal
RL: **CAT (Catalyst use)**; NUU (Other use, unclassified); RCT (Reactant); RACT (Reactant or reagent); USES (Uses)
(in catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT 64-18-6, Formic acid, uses 546-93-0, Magnesium carbonate
1309-42-8,
Magnesium hydroxide 1309-48-4, Magnesium oxide, uses
RL: **CAT (Catalyst use)**; RCT (Reactant); RACT (Reactant or reagent); USES (Uses)
(catalyst preparation from; catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT 7758-11-4, Dipotassium phosphate 56378-72-4, Basic magnesium carbonate
RL: **CAT (Catalyst use)**; USES (Uses)
(catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT 471-34-1, Calcium carbonate, uses
RL: **CAT (Catalyst use)**; NUU (Other use, unclassified); USES (Uses)
(catalytic conversion of **water** and **carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT 74-82-8P, Methane, preparation 74-84-0P, Ethane, preparation 630-08-0P, Carbon monoxide, preparation 1333-74-0P, Hydrogen, preparation 7782-44-7P, Oxygen, preparation
RL: PNU (Preparation, unclassified); PREP (Preparation)
(catalytic conversion of **water** and **carbon**

dioxide to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT 124-38-9, **Carbon dioxide**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(catalytic conversion of **water and carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

IT 12597-69-2, Steel, uses
RL: **CAT (Catalyst use)**; NUU (Other use, unclassified); USES
(Uses)
(shavings; in catalytic conversion of **water and carbon dioxide** to low-cost energy, **hydrogen, carbon monoxide, oxygen** and hydrocarbons)

L60 ANSWER 43 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 126:187930 HCA
ED Entered STN: 01 Apr 1997
TI Mechanisms of flame quenching by chlorine in well-stirred reactors
AU Casias, C. R.; McKinnon, Thomas J.
CS Department Chemical Engineering Petroleum Refining, Colorado School Mines,
Golden, CO, 80401, USA
SO Combustion Science and Technology (1996), 116-117(1-6), 289-315
CODEN: CBSTB9; ISSN: 0010-2202
PB Gordon & Breach
DT Journal
LA English
CC 48-8 (Unit Operations and Processes)
Section cross-reference(s): 50, 60
AB An evaluation of chlorine inhibition effects on hydrocarbon combustion processes was made using an elementary reaction mechanism consisting of 305 reversible reactions and 77 species. The evaluation was conducted, by adding 1% (mole basis) elemental chlorine to fuel-lean and fuel-rich C2H4 air mixts., and running numerical simulations based on a perfectly-stirred reactor configuration. The evaluation included anal. of chlorine-catalyzed free radical recombination cycles, carbon flux pathways, principal chain branching reactions, free radical flux pathways, chlorine flux pathways, and reaction **exothermics**. Addnl., the evaluation incorporated the use of a hypothetical mol. "deuterium" that possessed thermodyn. **properties** similar to **hydrogen** and chemical **properties** similar to chlorine. From this evaluation, it

was determined that both chemical and thermal effects result from the addition of

chlorine. The primary chemical effect results from suppression of the O atom

concentration. The primary thermal effect results from suppression of the highly

exothermic H₂O formation channel due to competition from HCl formation channels. Thermal effects were determined to be the mechanism

primarily responsible for flame quenching in a well-stirred reactor. ST ethene flame quenching chlorine reaction mechanism; incineration chlorine

ethene flame quenching

IT Hydrocarbons, processes

RL: PEP (Physical, engineering or chemical process); RCT (Reactant); PROC

(Process); RACT (Reactant or reagent)

(chloro; kinetic modeling of flame quenching by chlorine in well-stirred reactors)

IT Combustion kinetics

Flame

Incineration

Quenching (cooling)

Reaction mechanism

Simulation and Modeling, physicochemical

(kinetic modeling of flame quenching by chlorine in well-stirred reactors)

IT Reactors

(stirred-tank; kinetic modeling of flame quenching by chlorine in well-stirred reactors)

IT 7782-50-5, Chlorine, processes 22537-15-1, Atomic chlorine, processes

RL: **CAT (Catalyst use)**; PEP (Physical, engineering or chemical process); RCT (Reactant); PROC (Process); RACT (Reactant or reagent);

USES

(Uses)

(modeled compound; kinetic modeling of flame quenching by chlorine in

well-stirred reactors)

IT 50-00-0, Formaldehyde, processes **74-85-1**, Ethene, processes

74-86-2, Ethyne, processes 79-01-6, Trichloroethene, processes

124-38-9, Carbon dioxide, processes

630-08-0, Carbon monoxide, processes

1333-74-0, Hydrogen, processes 2597-44-6, Formyl

2669-89-8, Ethenyl 3352-57-6, Hydroxyl, processes 7647-01-0,

Hydrogen chloride, processes **7732-18-5, Water**,

processes 7782-39-0, Deuterium d₂, processes **7782-44-7**,

Oxygen, processes 12385-13-6, Atomic **hydrogen**,

processes 17778-80-2, Atomic **oxygen**, processes
 RL: PEP (Physical, engineering or chemical process); RCT (Reactant);
 PROC (Process); RACT (Reactant or reagent)
 (modeled compound; kinetic modeling of flame quenching by chlorine
 in well-stirred reactors)

L60 ANSWER 44 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN
 AN 1994-177932 [22] WPIX
 DNC C1994-081330
 TI Combined reformer and shift reactor - with compact arrangement of
auto thermal reformer and shift reaction chambers
 requiring no external heat input.
 DC H04 J04
 IN COLLINS, R D; OAKLEY, M J
 PA (RORO) ROLLS ROYCE & ASSOC LTD; (RORO) ROLLS-ROYCE & ASSOC LTD; (RORO)
 ROLLS ROYCE PLC
 CYC 7
 PI EP 600621 A1 19940608 (199422)* EN 15 C01B003-48
 R: DE FR GB IT
 CA 2109655 A 19940603 (199431) C01B003-34
 JP 06239601 A 19940830 (199439) 11 C01B003-38
 US 5458857 A 19951017 (199547) 16 F28D007-04
 EP 600621 B1 19970416 (199720) EN 18 C01B003-48
 R: DE FR GB IT
 DE 69309862 E 19970522 (199726) C01B003-48
 ADT EP 600621 A1 EP 1993-308941 19931109; CA 2109655 A CA 1993-2109655
 19931122; JP 06239601 A JP 1993-302766 19931202; US 5458857 A US
 1993-155642 19931122; EP 600621 B1 EP 1993-308941 19931109; DE
 69309862 E
 DE 1993-609862 19931109, EP 1993-308941 19931109
 FDT DE 69309862 E Based on EP 600621
 PRAI GB 1992-25188 19921202
 REP EP 112613; EP 361648; US 3438759; US 3541729; US 3796547; US 3909299
 IC ICM C01B003-34; C01B003-38; C01B003-48; F28D007-04
 ICS B01J019-00; B01J023-40; B01J023-80; B01J023-89; C01B003-36
 AB EP 600621 A UPAB: 19940722
 Combined reformer and shaft reactor (310) comprises: (a) a reforming
 chamber (322) containing a reforming catalyst (324) and supplied with
water via an annular steam generator (316) arranged around the
 reforming chamber and **oxygen** and hydrocarbon via pipes (370)
 extending through the space between the reforming chamber and steam
 generator; (b) annular flow paths (358), (360) and a chamber (362) to
 transfer the product gases from the reforming chamber to shift
 reaction
 chambers (314); (c) low temperature shift reaction chambers (314)
 containing low

temperature shift reaction catalyst (338) and forming a combined unit with the steam generator to transfer heat to the **water** (332) before it is supplied to the reforming chamber; and (d) an outlet chamber (364) and pipe (376) for the exit of **hydrogen** and carbon dioxide.

USE/ADVANTAGE - In the generation of **hydrogen** for fuel cells or other purposes by reforming hydrocarbon fuels. Hydrocarbon rich gas of low **carbon monoxide** concentration is produced more thermally efficiently than in conventional reforming equipment especially at low production rates. The equipment is compact and produces **hydrogen** of a quality suitable for fuel cells in a single unit. No external heat transfer equipment is required to preheat the reactants or to generate steam. The unit has good load following characteristics and good turn down capability.

Dwg.1/3

FS CPI

FA AB; GI

MC CPI: H04-C02; H06-A; J04-E02; N06-D

L60 ANSWER 45 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 121:207975 HCA

ED Entered STN: 29 Oct 1994

TI Partial oxidation of alkanes over noble metal coated monoliths

AU Huff, M.; Tornaiainen, P. M.; Schmidt, L. D.

CS Department of Chemical Engineering and Materials Science, University of

Minnesota, Minneapolis, Minnesota 55455, USA

SO Catalysis Today (1994), 21(1), 113-28

CODEN: CATTEA; ISSN: 0920-5861

DT Journal

LA English

CC 45-4 (Industrial Organic Chemicals, Leather, Fats, and Waxes)

Section cross-reference(s): 35

AB The production of olefins and synthesis gas (**CO** and **H2**)

from CH₄, C₂H₆, C₃H₈, and n-C₄H₁₀ in the presence of air or **O2**

at atmospheric pressure has been examined over monoliths coated with various metals

at residence times between 10⁻³ and 10⁻² s. Expts. are carried out by feeding gases at atmospheric pressure and 25°C into an **autothermal** monolith reactor operating between 800 and 1200°C. In CH₄ oxidation, >90% selectivity to syngas is achieved over Rh at >90% CH₄ conversion, while Pt forms more **H2O**, Ir sinters, and Ni volatilizes. In

C₂H₆ oxidation, Pt forms up to 70% selectivity to C₂H₄, while Rh gives up to

70% selectivity to syngas, and Pd forms solid carbon. Carbon formation is suppressed under conditions where graphite formation is predicted on some metals, **but** forms readily on others. The C₂H₆ results can be interpreted quite simply in terms of **hydrogen** abstraction by adsorbed **oxygen** to form the alkyl, followed by β -**hydrogen** elimination to yield the olefin (Pt) or pyrolysis to yield syngas (Rh) or carbon (Pd). When C₃H₈ and n-C₄H₁₀ are used, considerable cracking to **ethylene** plus alkane is also observed

ST oxidn alkane alkene syngas prepn; noble metal catalyst alkane oxidn; platinum catalyst alkane oxidn; rhodium catalyst alkane oxidn; iridium catalyst alkane oxidn; nickel catalyst alkane oxidn

IT Oxidation
(mechanism; partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT Group VIII elements
RL: **CAT (Catalyst use)**; USES (Uses)
(noble; partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT Heat of oxidation
Oxidation catalysts
(partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT Alkanes, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(C1-4, partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT Alkenes, preparation
RL: IMF (Industrial manufacture); PREP (Preparation)
(C2-4, partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT **124-38-9P, Carbon dioxide**, preparation
7732-18-5P, Water, preparation
RL: BYP (Byproduct); PREP (Preparation)
(partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT **7439-88-5, Iridium**, uses **7440-02-0, Nickel**, uses **7440-06-4, Platinum**, uses **7440-16-6, Rhodium**, uses
RL: **CAT (Catalyst use)**; USES (Uses)
(partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT **74-85-1P, Ethylene**, preparation **115-07-1P, Propylene**, preparation **630-08-0P, Carbon**

monoxide, preparation 1333-74-0P, **Hydrogen**,

preparation 25167-67-3P, **Butylene**

RL: IMF (Industrial manufacture); PREP (Preparation)

(partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT 74-82-8, **Methane**, reactions 74-84-0,

Ethane, reactions 74-98-6, **Propane**, reactions

106-97-8, **Butane**, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

IT 1344-28-1, **Alumina**, uses

RL: **CAT (Catalyst use)**; USES (Uses)

(α -, support; partial oxidation of alkanes to alkenes and syngas over noble metal-coated alumina monoliths)

L60 ANSWER 46 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 116:258498 HCA

ED Entered STN: 27 Jun 1992

TI Catalytic process for the production of synthesis gas by means of reforming and combustion reactions.

IN Basini, Luca; Marchionna, Mario; Sanfilippo, Domenico; Rossini, Stefano

PA Snamprogetti SpA, Italy

SO Brit. UK Pat. Appl., 25 pp.

CODEN: BAXXDU

DT Patent

LA English

IC ICM C01B003-34

CC 49-1 (Industrial Inorganic Chemicals)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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PI	GB 2247465	A1	19920304	GB 1991-18116	19910822
	GB 2247465	B2	19941109		
	NO 9103360	A	19920302	NO 1991-3360	19910827
	CA 2050143	AA	19920301	CA 1991-2050143	19910828
	CN 1059318	A	19920311	CN 1991-108515	19910828
PRAI	IT 1990-21326	A	19900829		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
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GB 2247465	ICM	C01B003-34
GB 2247465	ECLA	B01J021/06; B01J023/22; B01J023/26; B01J023/40; B01J023/58; B01J023/63; B01J023/74; C01B003/38A;

AB Synthetic gas is manufactured from hydrocarbon by two-reaction stages in one or

more reactors. In the 1st stage of **exothermic** combustion

reaction, the hydrocarbon or hydrocarbon mixture or carbon is reacted with air and/or O to form **CO2** and **H2O**. In the 2nd stage of reforming reaction, the product of the **exothermic** combustion reaction(s) is reacted with a hydrocarbon or hydrocarbon mixture in the presence of a catalytic system. The synthetic gas manufactured comprises

CO, **H**, **CH4**, **CO2**, and/or **N**.

ST synthetic gas manuf **exothermic** combustion; reforming reaction
synthetic gas manuf

IT Hydrocarbons, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(**exothermic** combustion of, in synthesis gas manufacturing)

IT Combustion

(**exothermic**, syngas manufacturing by reforming reaction and, from hydrocarbon)

IT Fuel gas manufacturing

(synthesis gas, from hydrocarbon, by **exothermic** combustion and reforming reaction two-stage process)

IT 1344-28-1, Alumina, uses 7631-86-9, Silica, uses

RL: **CAT (Catalyst use)**; **USES (Uses)**

(catalyst support, in synthesis gas manufacture from hydrocarbon,

by

exothermic combustion and reforming reaction two-stage process)

IT 1308-06-1, Cobalt tetraoxide 1309-37-1, Ferric oxide, uses

1313-13-9,

Manganese dioxide, uses 1313-99-1, Nickel oxide, uses 1314-13-2,

Zinc

oxide, uses 1314-34-7, Vanadium trioxide 1317-38-0, Cupric oxide,

uses

1333-82-0, Chromium trioxide **7440-05-3**, Palladium, uses

7440-06-4, Platinum, uses **7440-16-6**, Rhodium, uses

7440-22-4, Silver, uses **7440-50-8**, Copper, uses

13463-67-7, Titania, uses

RL: **CAT (Catalyst use)**; **USES (Uses)**

(catalyst, in synthesis gas manufacture from hydrocarbon, by

exothermic combustion and reforming reaction two-stage process)

IT **7782-44-7P**

RL: **PREP (Preparation)**

(combustion, **exothermic**, syngas manufacturing by reforming reaction and, from hydrocarbon)

IT **74-82-8P**, **Methane**, preparation **124-38-9P**,

Carbon dioxide, preparation **630-08-0P**,

Carbon monoxide, preparation **1333-74-0P**,

Hydrogen, preparation 7727-37-9P, **Nitrogen**, preparation

RL: **PREP (Preparation)**

(synthetic gas containing, manufacture of, from hydrocarbon, by

exothermic combustion and reforming reaction two-stage process)

L60 ANSWER 47 OF 54 HCA COPYRIGHT 2004 ACS on STN
AN 117:120412 HCA
ED Entered STN: 20 Sep 1992
TI Modeling of **hydrogen** cyanide synthesis in a solid electrolyte
fuel cell
AU McKenna, Elizabeth; Stoukides, Michael
CS Dep. Chem. Eng., Tufts Univ., Medford, MA, 02155, USA
SO Chemical Engineering Science (1992), 47(9-11), 2951-6
CODEN: CESCAC; ISSN: 0009-2509
DT Journal
LA English
CC 72-4 (Electrochemistry)
Section cross-reference(s): 52, 67, 78
AB The synthesis of HCN from CH₄, NH₃ and air was achieved with **co**
-generation of elec. energy in an yttria-stabilized zirconia (YSZ)
cell
with Pt electrodes operating at 750-1000°. In addition to HCN the
exit stream contained N₂, **CO**, **H₂O** and occasionally
CO₂ and N₂O. A kinetic model was prepared considering 14 reactions
occurring simultaneously at the anode. The effects of temperature, **O₂**
- flux, inlet gas composition, and inlet gas velocity on the HCN
yield and on
the overall **exothermicity** of the system were examined. It was
found that the cell can operate adiabatically if the CH₄/NH₃ feed
ratio is
higher than 1.25. Two different cell designs were examined, one in
which
the anode is inside the YSZ tube, and one in which air flows inside
the
tube and the fuel flows outside perpendicular to the direction of air
flow. The latter design exhibits certain addnl. advantages over the
traditional tubular cell design.
ST hydrocyanic acid prepn fuel cell; electrolytic cell hydrocyanic acid
prepn; electrolyzer hydrocyanic acid prepn power generation; kinetics
reaction hydrocyanic acid fuel cell
IT Fuel cells
(ammonia-**methane**, hydrocyanic acid preparation in relation to)
IT Energy balance
Mass balance
Oxidation, electrochemical
(in hydrocyanic acid preparation in solid-electrolyte fuel cell)
IT Kinetics, reaction
Kinetics of oxidation
(in hydrocyanic synthesis in solid-electrolyte fuel cell)
IT **7440-06-4**, Platinum, uses
RL: USES (Uses)

(electrodes, in cell with yttria-stabilized zirconia electrolyte
for hydrocyanic acid preparation with cogeneration of elec. energy)
IT 1314-23-4, Zirconia, **properties**
RL: PRP (Properties)
(electrolyte, yttria-stabilized, in cell with platinum electrodes
in hydrocyanic acid preparation with cogeneration of elec. energy)
IT 124-38-9P, **Carbon dioxide**, preparation
630-08-0P, **Carbon monoxide**, preparation
7727-37-9P, Nitrogen, preparation 7732-18-5P, **Water**,
preparation 10024-97-2P, Nitrogen oxide (N2O), preparation
RL: FORM (Formation, nonpreparative); PREP (Preparation)
(formation of, in hydrocyanic acid synthesis in solid electrolyte
fuel cell)
IT 74-90-8P, Hydrocyanic acid, preparation
RL: PREP (Preparation)
(preparation of, in solid electrolyte fuel cell, modeling of)
IT 74-82-8, **Methane**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(reaction of, with ammonia and air in yttria-stabilized zirconia
cell with platinum electrodes with cogeneration of elec. energy)
IT 7664-41-7, Ammonia, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(reaction of, with **methane** and air in yttria-stabilized
zirconia cell with platinum electrodes with cogeneration of elec.
energy)
IT 7782-44-7, **Oxygen**, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(reduction of, electrochem., in hydrocyanic acid preparation in
solid electrolyte fuel cell)
IT 1314-36-9, Yttria, **properties**
RL: PRP (Properties)
(zirconia electrolyte stabilized with, in cell with platinum
electrode for hydrocyanic acid preparation with cogeneration of elec. energy)

L60 ANSWER 48 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN
AN 1991-187597 [26] WPIX
CR 1989-151890 [21]; 1991-318684 [44]; 1992-040880 [05]
DNC C1991-081204
TI Direct reduction of metal oxide(s) using a single reaction zone - for
production of direct reduced **iron**.
DC M24

IN BUENOC, H R; DAMG, O G; BUENO, H R C; DAM, O G G; BUENO, C H R; DAM,
G O G
PA (CVGS-N) CVG SIDER DEL ORINOCO; (CVGS-N) CVG SIDERURG ORIN
CYC 6
PI GB 2239261 A 19910626 (199126)* 18
DE 4025320 A 19910711 (199129)
CA 2014308 A 19910622 (199135)
BR 9003744 A 19910903 (199140)
US 5064467 A 19911112 (199148)
JP 03274213 A 19911205 (199204)
GB 2239261 B 19940119 (199403) C21B013-00
DE 4025320 C2 19940224 (199408) 6 C21B013-02
JP 07088525 B2 19950927 (199543) 6 C21B013-00
CA 2014308 C 19981215 (199909) C21B013-00
ADT GB 2239261 A GB 1990-8415 19900412; US 5064467 A US 1989-453232
19891222;
JP 03274213 A JP 1990-298778 19901102; GB 2239261 B GB 1990-8415
19900412;
DE 4025320 C2 DE 1990-4025320 19900810; JP 07088525 B2 JP 1990-298778
19901102; CA 2014308 C CA 1990-2014308 19900410
FDT JP 07088525 B2 Based on JP 03274213
PRAI US 1989-455232 19891222; US 1987-115911 19871125;
US 1989-453232 19891222
IC C21B011-02; C21B013-00; C21B015-00; C22B005-12
ICM C21B013-02
ICS C21B011-02; C21B015-00; C22B005-12
AB GB 2239261 A UPAB: 19950927
A process for the direct reduction of metal oxides containing Fe to
DRI metallised
Fe is described. The reduction reactor has a single reaction zone
containing a bed
of partially metallised **iron** oxide material and reduced Fe. A
reformed reducing gas rich in **H2** and **CO** is formed
within the reaction zone, and effects the reduction
Fe-containing oxides may be in pellet form, typically 63-68
weight% Fe. The
reduction prod. is 85-90 weight% Fe. The source of reformed gas is
natural gas.
USE/ADVANTAGE - The production of direct reduced Fe from
Fe-containing
oxides. Only a single reaction zone, with no additional catalysts, is
used. The simultaneous reforming-reduction method improves efficiency
and
reduces energy consumption. The DRI material functions as a
reformation
catalyst. The **endothermic** surface reactions hinder sintering.
@ (18pp Dwg.No.0/1)
0/1

FS CPI
FA AB
MC CPI: M24-A03

L60 ANSWER 49 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 112:161829 HCA

ED Entered STN: 28 Apr 1990

TI GEMEKS - combined methanol-hydrocarbon cracking. A new approach to olefins

AU Nowak, Siegfried; Guenschel, Hubert; Anders, Klaus; Martin, Andreas; Luecke, Bernhard

CS Zentralinst. Org. Chem., Akad. Wiss. DDR, Berlin, Ger. Dem. Rep.

SO Erdoel & Kohle, Erdgas, Petrochemie (1990), 43(2), 57-61

CODEN: EKEPAB; ISSN: 0014-0058

DT Journal

LA German

CC 51-6 (Fossil **Fuels**, Derivatives, and Related Products)
Section cross-reference(s): 23, 45, 52

AB A new catalytic way for the production of low olefins from MeOH/hydrocarbon

mixts. was studied. The results obtained in a fixed-bed reactor showed

that the combination of the exothermic MeOH transformation with the endothermic hydrocarbon cracking over a modified H-ZSM-5 catalyst allowed

to establish an overall **thermo-neutral** reaction and consequently, a more simple design of the process. Depending on the process conditions and the feedstock a high space time yield of low olefins (600-1000 g/kg-h), preferentially C₂H₄, and furthermore also C₆H₆,

PhMe, and xylene, and a high-grade gasoline were obtained.

ST methanol hydrocarbon cracking gasoline olefin

IT Hydrocarbons, reactions

RL: PREP (Preparation)

(cracking of mixts. of methanol and, gasoline and olefin preparation by)

IT Alkenes, preparation

Aromatic hydrocarbons, preparation

Gasoline

RL: PREP (Preparation)

(manufacture of, by combined methanol-hydrocarbon cracking)

IT Petroleum refining catalysts

(zeolites, for combined methanol-hydrocarbon cracking in gasoline and olefin preparation)

IT Zeolites, uses and miscellaneous

RL: **CAT (Catalyst use)**; USES (Uses)

(HZSM 5, catalysts, for combined methanol-hydrocarbon cracking in

gasoline and olefin preparation)
IT Petroleum refining
(cracking, of methanol-hydrocarbon mixts., gasoline and olefin
preparation
of)
IT .67-56-1, Methanol, reactions
RL: USES (Uses)
(cracking of mixts. of hydrocarbon and, gasoline and olefin
preparation by)
IT 124-18-5, n-Decane
RL: USES (Uses)
(cracking of mixts. of methanol and, gasoline and olefin
preparation by)
IT 71-43-2P, Benzene, preparation 74-82-8P, Methane, preparation
74-85-1P, Ethylene, preparation 106-99-0P, Butadiene, preparation
108-88-3P, Toluene, preparation 115-07-1P, Propylene, preparation
1330-20-7P, Xylene, preparation **1333-74-0P**, Hydrogen,
preparation
RL: **PREP (Preparation)**
(manufacture of, by combined methanol-hydrocarbon cracking)
IT 1335-30-4
RL: USES (Uses)
(zeolites, HZSM 5, catalysts, for combined methanol-hydrocarbon
cracking in gasoline and olefin preparation)

L60 ANSWER 50 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN
AN 1984-127535 [21] WPIX
DNC C1984-053889
TI **Auto-thermal** reforming by partial oxidation and steam
reforming - using monolithic **platinum**-gp.-metal-containing partial
oxidation catalyst.
DC H04 H09
IN BUCHANAN, W; FLANAGAN, P; HECK, R M; MCSHEA, W T; YARRINGTON, R M
PA (ENGH) ENGELHARD MINERALS CORP; (ENGH) ENGELHARD CORP
CYC 18
PI AU 8319728 A 19840405 (198421)* 104
NO 8303522 A 19840424 (198423)
DK 8304483 A 19840514 (198426)
EP 112613 A 19840704 (198427) EN
R: AT BE CH DE FR GB IT LI LU NL SE
JP 59097501 A 19840605 (198428)
ES 8503717 A 19850616 (198549)
CA 1210242 A 19860826 (198639)
CA 1210567 A 19860902 (198640)
CA 1217504 A 19870203 (198711)
CA 1222631 A 19870609 (198727)
US 4844837 A 19890704 (198934)
US 4863707 A 19890905 (198945)

US 4927857 A 19900522 (199024)
 EP 112613 B 19910306 (199110)
 R: AT BE CH DE FR GB IT LI LU NL SE
 DE 3382193 G 19910411 (199116)
 US 5023276 A 19910611 (199126)
 NO 171409 B 19921130 (199302) C01B003-38
 ADT AU 8319728 A AU 1983-19728 19830929; EP 112613 A EP 1983-305887
 19830929;
 JP 59097501 A JP 1983-179530 19830929; US 4844837 A US 1982-430451
 19820930; US 4863707 A US 1989-296385 19890106; US 4927857 A US
 1989-298875 19890118; US 5023276 A US 1989-300197 19890119; NO 171409
 B NO
 1983-3522 19830929
 FDT NO 171409 B NO 8303522
 PRAI US 1982-430147 19820930; US 1982-430200 19820930;
 US 1982-430320 19820930; US 1982-430451 19820930;
 US 1982-430452 19820930
 REP 1.Jnl.Ref; A3...8732; DE 1417796; FR 1490005; No-SR.Pub; US 3481722;
 US
 4053556; US 4054407
 IC ICM C01B003-38
 ICS B01J023-44; C01B003-32; C01C001-04; C07C027-06; C07C029-15;
 C07C031-04
 AB AU 8319728 A UPAB: 19930925
 Production of synthesis gas is effected in two stages: (i) catalytic
 partial
 oxidation of a feed mixture comprising hydrocarbon feed stream, **H2O**
 and **O2**-containing gas; the preheated feed mixture being contacted with
 a monolithic (honeycomb-type) catalyst (I) comprising Pd and Pt
 (andopt.
 Rh) on a refractory metal oxide, and (ii) catalytic steam reforming
 of the
 first-stage effluent over a Pt-Rh steam reforming catalyst.
 Specifically, the feed mixture to stage (i) is controlled to
 give an
H2O:C ratio of 0.5-5 and an **O2**:C ratio of 0.2-0.8, and
 the step is carried out at 1-142 atmospheric and at such temps. that
 at least
 part of (I) is at at least 121 deg.C above the ignition temperature
 of the inlet
 stream, providing cracking of any unoxidised 5C + hydrocarbons to
 light
 (4C or below) hydrocarbons.
 The specifically claimed embodiments relate to integrated
 processes
 utilising the **H2**-rich product gas for the production of (A) ammonia,
 (B) **methanol**, (C) SNG and (D) liquid hydrocarbons. Very low
 catalytic metal loadings may be used. Operation is at relatively low

H2O:C and **O2:C** ratios, without catalyst fouling by C deposition.

0/7

FS CPI

FA AB

MC CPI: H04-C01; H04-C02; H04-F02C; N02-E; N02-F02

L60 ANSWER 51 OF 54 WPIX COPYRIGHT 2004 THE THOMSON CORP on STN

AN 1979-89197B [49] WPIX

TI Hydrodesulphurisation purification process for coal gasification - where

nickel or **cobalt**, and molybdenum catalysts are used without causing runaway **methanation**.

DC H09

IN BRITTON, M W; DEW, J N; HARLACHER, E A

PA (CONO) CONOCO METHANATION

CYC 1

PI US 4175928 A 19791127 (197949)*

PRAI US 1975-637919 19751205; US 1976-725761 19760923;

US 1977-808425 19770620; US 1978-928339 19780727

IC C10K001-20

AB US 4175928 A UPAB: 19930901

The removal of organic S cpds. (I) (**CO**S, CS₂, mercaptans and thiophenes) from a gas mixture also comprising **H2** and ≥ 10 mol.% **CO**, the **H2** being present in an amount such that the **H2/CO** ratio is 2-4 comprises converting (I) to H₂S (so that the gas mixture contains < 0.2 ppmv S) by contact with a sulphided catalyst comprising ≥ 1 Ni (cpd.) or **Co** (cpd.) and ≥ 1 Mo (cpd.) on a suitable carrier.

Improvement comprises adjusting the gas mixture compsn. to a H₂S content of 25-100 ppmv and a **water** content of 0.1-15 weight% and contacting this adjusted mixture with the catalyst at a space velocity of

1500-5000 hr⁻¹ and a temperature of 425-700 degrees F.

Also claimed is a process where the starting gas also contains **CO2** and where after reacting coal with **water** and

O2 at high temps. and adjusting the **H2/CO**

ratio, the gas (now a synthesis gas) is contacted with aqueous alkaline solution

to remove a major amount of the **CO2** and acidic S cpds. and is then contacted with the catalyst as above.

Ni/Mo and **Co/M** catalyst can be used in large scale S hydrogenation reactors without runaway **methanation** and resulting **exotherms** while still converting all the organic cpds. to H₂S. The catalysts do not become desulphurised.

FS CPI

FA AB

MC CPI: H09-C

L60 ANSWER 52 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 48:47931 HCA

OREF 48:8498i,8499a-d

ED Entered STN: 22 Apr 2001

TI Conversion of hydrocarbons by **oxygen, water, and carbon dioxide** to form **hydrogen**

AU Marcu, Liviu

SO Chimie et Industrie (Paris) (1953), 70, 677-93

CODEN: CHIEAN; ISSN: 0009-4358

DT Journal

LA Unavailable

CC 18 (Acids, Alkalies, Salts, and Other Heavy Chemicals)

AB A review of the manufacturing procedures in which CH₄ is converted to H by means

of O, **H₂O**, and **CO₂**. A low S content is essential and is accomplished by removing H₂S from the CH₄ with Fe₂O₃ + ZnO or by alkaline

or oxidative scrubbing. Organic S (**COS**, CS₂, mercaptans) is removed by hydrogenation, oxidation, and adsorption. In the partial combustion, CH₄ + 1/2O₂ → **CO** + 2H₂, the initial gases are preheated to 700-800°. Slight amts. of steam are added on the outlet side of the heat exchanger in order to prevent C deposits and on

the outlet side of the catalyst bed in order to convert unconverted CH₄.

The converted gas is directed through the exchanger mantles, further cooled, scrubbed, passed through a **CO** converter, cooled. By this procedure 3000-8300 cu. m./hr. of CH₄ can be converted in a catalyst bed 40 ft. high and 11.5 ft. in diameter. The drawback is that the CH₄ must

be diluted to 30% in order to prevent C deposits. In case atmospheric air can be

used in place of O, this procedure is very efficient. **Water-gas** conversion, CH₄ + **H₂O** → **CO** + 3H₂, is accomplished much in the same manner. The preheating temperature is 950-1000°, and Ni catalysts are used mostly. This process is convenient in production of NH₃, MeOH, and hydrogenated oils. Gases rich

in **CO₂** are usually converted by **CO₂** conversion, 3CH₄ + **CO₂** + 2H₂O → 8H₂ + 4CO, this reaction being chosen in order to achieve a **H₂-CO** ratio of 2:1 (MeOH production). The reaction takes place at 800° in the presence of Ni catalysts. Multitube reactors are usually used. As indicated above the converted gases all contain **CO**. In case it is desirable to remove this **CO**, the gas is passed over an Fe catalyst at 450-500° (**CO** + **H₂O** → **CO₂** + **H₂** + 9.8

kcal.)). This process, owing to its **exothermic** nature, can be used with any of the processes above, and the heat evolved used in heat

exchange in the preheating or other suitable phase of the entire ensemble

of processes.

IT Hydrocarbons

(**hydrogen** manufacture from)

IT Catalysts

(in **carbon monoxide** removal from H, Fe as)

IT Steam

(in **hydrogen** manufacture from hydrocarbons)

IT Catalysts

(in **hydrogen** manufacture from hydrocarbons, Ni as)

IT Oxidation

(in removal of CS₂, **COS** and mercaptans, from hydrocarbons)

IT Hydrogenation

(of **carbon monoxide**, over Fe catalysts in manufacture of hydrocarbon oils)

IT Hydrogenation

(of hydrocarbons, removal of CS₂, **COS** and mercaptans by)

IT Adsorption

(of sulfur compds., from hydrocarbons)

IT Thiols

(removal of, from hydrocarbons)

IT **7439-89-6, Iron**

(as catalyst, in **CO** removal from H)

IT **7440-02-0, Nickel**

(as catalyst, in hydrogenation of **CO**)

IT **74-82-8, Methane**

(**hydrogen** manufacture from)

IT **124-38-9, Carbon dioxide 7782-44-7, Oxygen**

(in **hydrogen** manufacture from hydrocarbons)

IT 1309-37-1, Iron oxide (Fe₂O₃) 1314-13-2, Zinc oxide

(in **hydrogen** sulfide removal from hydrocarbons)

IT 67-56-1, **Methanol**

(manufacture of, H for)

IT **1333-74-0, Hydrogen**

(manufacture of, from hydrocarbons)

IT 7664-41-7, Ammonia

(manufacture of, synthesis, gas for)

IT 463-58-1, Carbonyl sulfide

(removal from hydrocarbon gases)

IT 75-15-0, Carbon disulfide

(removal of, from CH₄)

IT **630-08-0, Carbon monoxide**

(removal of, from H)

IT 7783-06-4, **Hydrogen** sulfide
(removal of, from hydrocarbons in H manufacture)

L60 ANSWER 53 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 38:32341 HCA

OREF 38:4774i,4775a-i,4776a-c

ED Entered STN: 16 Dec 2001

TI Work of the Gas Research Board. Report of the Director

AU King, J. G.

SO Gas World (1944), 120;121, 6245;18

CODEN: GAWOAG; ISSN: 0016-5026

DT Journal

LA Unavailable

CC 21 (Fuels and Carbonization Products)

AB In investigations on the complete gasification of British coals,
laboratory

studies were made on the actions of H and of synthetic gas mixts. on
both

coal and cokes. Coals and semicokes can be converted to gaseous and
liquid hydrocarbons by the action of H under pressure. The reaction

is strongly **exothermic**. The yield of gaseous hydrocarbons exceeds
100 therms per ton; liquid hydrocarbons are also obtained in high

yield and are of a "primary character." The coke is finely porous and
highly

reactive. The process may be combined with others, for example, with
one

involving the production of H by the pressure gasification of coke, or
part of it, with O and steam in a Lurgi generator, or with a process

of CH₄ synthesis from gaseous mixts. containing H and **CO**. Expts. with
steam and with **CO₂** showed that several factors are involved in
the gasification of coke. They also showed how the consts. governing

the successive stages for any coke can be evaluated. In expts. on the
synthesis of CH₄, with a granular Ni catalyst and with passage of the
gas

at atmospheric pressure, a low reaction temperature (350-500°) led to
loss of

catalyst activity and deposition of C, as the result of the
development of

a high surface temperature where the reaction gases first come into
contact with

the catalyst. The rate of loss of activity is increased by a
decrease in

the ratio **H₂/CO**; in practice it may be necessary to

employ a ratio above 1.2. The addition of steam counteracts the
tendency to

form C from the **CO** and also under certain circumstances prevents the loss of catalyst activity caused by sintering. The surface temperature can

also be controlled by recirculation and by use of a shaped or rod catalyst

arranged to lose heat rapidly by radiation. By use of these expedients it

is possible to operate the simple Ni catalyst at any temperature within the

range 350 to 800° and at any pressure within the range 1 to 50 atmospheric

In the synthesis from **water** gas with high **H₂/**

CO ratios the most suitable catalyst for work at a relatively low temperature is Ni promoted by thoria and supported on kieselguhr.

The S in the

gas is kept below 0.1 grain per 100 cu. ft. by using an iron oxide-**Na₂CO₃**

contact material at 180 to 230°. With purified **water**

gas, the catalyst life was 77 days, during which time the CH₄ content of

the **CO₂**-free gas varied from 80 down to 30% with an average of 65%.

In order to prevent undue deposition of C the **H₂/CO**

ratio must be kept above 1.5. Other factors affecting the formation of C

are the rise in temperature of the catalyst, its size, and a rise in pressure

above atmospheric. The gas should be passed downward through the catalyst. Under

these conditions and with an exit temperature of 350°, the process gas can be treated at the rate of 3700 vols. per volume of catalyst per hr.

Difficulties were encountered in developing these results to a semiscale

apparatus processing 5000 cu. ft. of gas per day. The S compds. cannot be

removed from coal gas to the desired extent by the method used with **water** gas. S is removed from coal gas by thorough washing with oil followed by passage over a suitable Fe hydrogenating catalyst and absorption of the H₂S formed. Unsatd. compds. can be satisfactorily removed only by freezing out. For eliminating organic S compds. from gas by

oxidation to SO₂ in the presence of a small amount of air or O, a Cu-Cr

catalyst supported on active C was developed. At temps. as low as 250° in one stage it decreased the S in **water** gas to 0.3

grain per 100 cu. ft., and in 3 stages to 0.002 grain. With coal gas, to

prevent poisoning of the catalyst the unsatd. compds. are removed by use

of a hydrogenating catalyst of the Mo sulfide type. A combined catalyst has a long life at 300° in the reduction of 20 grains of organic S per 100 cu. ft. to 2 grains. The first catalyst also promotes the combustion of any O₂ present in the coal gas, and thus liberates heat, which assists in maintaining the temperature of the catalyst. H₂S formed from the organic S compds. must be removed by iron oxide catch boxes; or, the second catalyst can be replaced by a reagent that not only acts as a catalyst **but** at the same time retains the H₂S as a metal sulfide. This second catalyst requires periodic renewal. Certain iron ores have been found suitable. Thiophene is the S compound that chiefly escapes destruction, **but** a Mo sulfide catalyst can be prepared that will decompose it at 300° almost completely. From coal of an ash content below 4.5%, uniformly graded over 1/2 in., and of slight to medium caking power can be produced coke satisfactory as a fuel in utility producers; by operating at a retort temperature 50° below the normal temperature and increasing the throughput, the normal output of gas per retort can be maintained. In extensive road trials, the utility producer gave satisfactory performance; 16 lb. of fuel is equivalent to 1 gal. of **gasoline**. In a study of the emission characteristics of refractory materials, it was shown that for Al₂O₃ the emission is selective and falls far short of that of a black body at the same temperature. The nature and the intensity of the emitted radiation can be considerably modified by the presence of small amts. of additives, such as Fe₂O₃ and Cr₂O₃. A study was made of the burning out of combustible materials used to develop porosity in clay refractories. The type of combustible matter used affected the cold-crushing strength of the fired product. Deformation of insulating fire bricks during firing can be reduced by curtailing the period of soaking at the maximum temperature. Studies on the spalling of fire bricks and the deformation of refractory materials at high temps. are reviewed.

IT Fuel, gas
(Research Board report)

IT Hydrocarbons
(by hydrogenation, of coal and coke)

IT Refractory materials
(emission characteristics, porosity development and spalling of)

IT Bricks
(fire or refractory, insulating, reducing deformation during firing and
reducing spalling of)

IT Illumination
(gas combustion characteristics and)

IT Coal
(gasification (complete) of, action of H and synthetic gases in)

IT Coke
(**hydrogen** and synthetic gas action on, in complete gasification of coal)

IT Catalysts
(in **methane** synthesis, Ni as)

IT Catalysts
(in sulfur removal from coal gas, Cu-Cr as)

IT Catalysts
(in thiophene decomposition, Mo sulfide as)

IT Porosity
(of clay refractories, burning out materials to develop)

IT Hydrogenation
(of coal and coke in complete gasification)

IT 1317-33-5, Molybdenum sulfide
(as catalyst, for decomposition of thiophene)

IT **7440-02-0**, Nickel
(as catalyst, in CH₄ synthesis)

IT 7440-47-3, Chromium
(as catalysts with Cu, for removing S from gas)

IT **7440-50-8**, Copper
(catalysts of Cr and, for removing S from gas)

IT 110-02-1, Thiophene
(decomposition of, on Mo sulfide catalyst)

IT 1344-28-1, Alumina
(emission characteristics of)

IT **74-82-8, Methane**
(manufacture of, from CO)

IT 7704-34-9, Sulfur
(removal of, from gases, Cu-Cr catalyst for)

L60 ANSWER 54 OF 54 HCA COPYRIGHT 2004 ACS on STN

AN 38:32340 HCA

OREF 38:4774i,4775a-i,4776a-c

ED Entered STN: 16 Dec 2001

TI Work of the Gas Research Board. Report of the Director

AU King, J. G.

SO Gas Journal (1944) 623-4, 660-1, 689, 691 (also in Gas Research Board Publication No. 8)
CODEN: GASJAF; ISSN: 0016-4941

DT Journal

LA Unavailable

CC 21 (Fuels and Carbonization Products)

AB In investigations on the complete gasification of British coals, laboratory studies were made on the actions of H and of synthetic gas mixts. on both coal and cokes. Coals and semicokes can be converted to gaseous and liquid hydrocarbons by the action of H under pressure. The reaction is strongly **exothermic**. The yield of gaseous hydrocarbons exceeds 100 therms per ton; liquid hydrocarbons are also obtained in high yield and are of a "primary character." The coke is finely porous and highly reactive. The process may be combined with others, for example, with one involving the production of H by the pressure gasification of coke, or part of it, with O and steam in a Lurgi generator, or with a process of CH₄ synthesis from gaseous mixts. containing H and CO. Expts. with steam and with CO₂ showed that several factors are involved in the gasification of coke. They also showed how the consts. governing the successive stages for any coke can be evaluated. In expts. on the synthesis of CH₄, with a granular Ni catalyst and with passage of the gas at atmospheric pressure, a low reaction temperature (350-500°) led to loss of catalyst activity and deposition of C, as the result of the development of a high surface temperature where the reaction gases first come into contact with the catalyst. The rate of loss of activity is increased by a decrease in the ratio **H₂/CO**; in practice it may be necessary to employ a ratio above 1.2. The addition of steam counteracts the tendency to form C from the CO and also under certain circumstances prevents the loss of catalyst activity caused by sintering. The surface temperature can also be controlled by recirculation and by use of a shaped or rod catalyst arranged to lose heat rapidly by radiation. By use of these expedients it

is possible to operate the simple Ni catalyst at any temperature within the range 350 to 800° and at any pressure within the range 1 to 50 atmospheric

In the synthesis from **water** gas with high **H₂/CO** ratios the most suitable catalyst for work at a relatively low temperature is Ni promoted by thoria and supported on kieselguhr. The S in the gas is kept below 0.1 grain per 100 cu. ft. by using an iron oxide-Na₂CO₃ contact material at 180 to 230°. With purified **water** gas, the catalyst life was 77 days, during which time the CH₄ content of

the **CO₂**-free gas varied from 80 down to 30% with an average of 65%. In order to prevent undue deposition of C the **H₂/CO** ratio must be kept above 1.5. Other factors affecting the formation of C

are the rise in temperature of the catalyst, its size, and a rise in pressure

above atmospheric. The gas should be passed downward through the catalyst. Under these conditions and with an exit temperature of 350°, the process gas can be treated at the rate of 3700 vols. per volume of catalyst per hr.

Difficulties were encountered in developing these results to a semiscale

apparatus processing 5000 cu. ft. of gas per day. The S compds. cannot be

removed from coal gas to the desired extent by the method used with **water** gas. S is removed from coal gas by thorough washing with oil followed by passage over a suitable Fe hydrogenating catalyst and absorption of the H₂S formed. Unsatd. compds. can be satisfactorily removed only by freezing out. For eliminating organic S compds. from gas by

oxidation to SO₂ in the presence of a small amount of air or O, a Cu-Cr

catalyst supported on active C was developed. At temps. as low as 250° in one stage it decreased the S in **water** gas to 0.3 grain per 100 cu. ft., and in 3 stages to 0.002 grain. With coal gas, to

prevent poisoning of the catalyst the unsatd. compds. are removed by use

of a hydrogenating catalyst of the Mo sulfide type. A combined catalyst

has a long life at 300° in the reduction of 20 grains of organic S per 100 cu. ft. to 2 grains. The first catalyst also promotes the combustion

of any **O₂** present in the coal gas, and thus liberates heat,

which assists in maintaining the temperature of the catalyst. H₂S formed from the organic S compds. must be removed by iron oxide catch boxes; or, the second catalyst can be replaced by a reagent that not only acts as a catalyst **but** at the same time retains the H₂S as a metal sulfide. This second catalyst requires periodic renewal. Certain iron ores have been found suitable. Thiophene is the S compound that chiefly escapes destruction, **but** a Mo sulfide catalyst can be prepared that will decompose it at 300° almost completely. From coal of an ash content below 4.5%, uniformly graded over 1/2 in., and of slight to medium caking power can be produced coke satisfactory as a fuel in utility producers; by operating at a retort temperature 50° below the normal temperature and increasing the throughput, the normal output of gas per retort can be maintained. In extensive road trials, the utility producer gave satisfactory performance; 16 lb. of fuel is equivalent to 1 gal. of **gasoline**. In a study of the emission characteristics of refractory materials, it was shown that for Al₂O₃ the emission is selective and falls far short of that of a black body at the same temperature. The nature and the intensity of the emitted radiation can be considerably modified by the presence of small amts. of additives, such as Fe₂O₃ and Cr₂O₃. A study was made of the burning out of combustible materials used to develop porosity in clay refractories. The type of combustible matter used affected the cold-crushing strength of the fired product. Deformation of insulating fire bricks during firing can be reduced by curtailing the period of soaking at the maximum temperature. Studies on the spalling of fire bricks and the deformation of refractory materials at high temps. are reviewed.

IT Fuel, gas
(Research Board report)

IT Hydrocarbons
(by hydrogenation, of coal and coke)

IT Refractory materials
(emission characteristics, porosity development and spalling of)

IT Bricks
(fire or refractory, insulating, reducing deformation during firing and

reducing spalling of)
IT Illumination
 (gas combustion characteristics and)
IT Coal
 (gasification (complete) of, action of H and synthetic gases in)
IT Coke
 (**hydrogen** and synthetic gas action on, in complete
 gasification of coal)
IT Catalysts
 (in **methane** synthesis, Ni as)
IT Catalysts
 (in sulfur removal from coal gas, Cu-Cr as)
IT Catalysts
 (in thiophene decomposition, Mo sulfide as)
IT Porosity
 (of clay refractories, burning out materials to develop)
IT Hydrogenation
 (of coal and coke in complete gasification)
IT 1317-33-5, Molybdenum sulfide
 (as catalyst, for decomposition of thiophene)
IT **7440-02-0**, Nickel
 (as catalyst, in CH₄ synthesis)
IT 7440-47-3, Chromium
 (as catalysts with Cu, for removing S from gas)
IT **7440-50-8**, Copper
 (catalysts of Cr and, for removing S from gas)
IT 110-02-1, Thiophene
 (decomposition of, on Mo sulfide catalyst)
IT 1344-28-1, Alumina
 (emission characteristics of)
IT **74-82-8, Methane**
 (manufacture of, from CO)
IT 7704-34-9, Sulfur
 (removal of, from gases, Cu-Cr catalyst for)

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